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S T U D I E S

of the

ROYAL COMMISSION ON TAXATION

Number 24

THE SOURCES OF ECONOMIC GROWTH

An Empirical Analysis of the Canadian Experience

by

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PREFACE

This study is an attempt to evaluate the effect of various economic policies on Canada's economic growth. The first chapter is devoted to clarifying the meaning of growth, and to justifying public concern with it.

Thereafter we turn to the more technical issue of investigating how the Canadian economy has grown in the past. Once the proximate determinants, or sources of this growth are evaluated, the analysis then focuses on the responsiveness of these sources to economic policies.

This sequence of analysis facilitates the examination of the growth impact of a variety of individual policies, together with particular combinations of these policies. One interesting use of the mechanism involves projections into the future based on various assumed general policies indicating alternative growth paths open to the Canadian economy.

The policies that most concern us here include primarily monetary, fiscal and tax structure changes, but the framework has wider applicability. Our concern with general economic policies rather than the specific policies recommended by the Royal Commission on Taxation is due to the tentativeness of a number of proposals at the time the research underlying the present study was undertaken. The framework is sufficiently flexible, however, to encompass a preliminary evaluation of the implication of the Commission's recommendations.


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This study is more than a joint enterprise, since the authors benefited from the advice and labours of others on the staff of the Royal Commission on Taxation at various stages in the work.

We are particularly indebted to Robert Scott, who developed the potential GNP series used in this study and drafted Appendix A. Claude Langlois carried out many of the computer runs, and Elmer Schaeffer and Nancy Bower served as research assistants in the later stages. Linda Musser patiently typed the tables and drafts and re-drafts of the main body of the text; Mrs. A. C. Lamb provided us with helpful editorial assistance and supervised the typing of the copy for the printer.

Douglas Hartle, the research director for the Commission, encouraged us throughout the work, and read the final version of the manuscript. The authors, however, remain solely responsible for errors of ommission and commission.

While the authors collaborated on all chapters of this study, Chapters III and IV are primarily the work of Lithwick; and Chapters II, V, and the potential GNP projections are primarily the work of Wilson.

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N. Harvey Lithwick

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A. THE CANADIAN PERSPECTIVE

The last half century has witnessed a growing awareness on the part of most Canadians of the tremendous impact economic events can exert on their individual and collective well-being. The social as well as economic consequences of massive unemployment or the rapid erosion of purchasing power through inflation are now recognized to be so serious as to require active government intervention to prevent the extreme fluctuations generated by the economic system in the past.

No less dramatic are the consequences of sustained economic growth. Steady economic advance has tripled our standard of living within two generations. Through economic growth a primarily agricultural nation has developed into a complex industrial and urban society. Economic growth has eliminated the mass poverty of our grandparents' era, and can provide us with the means of totally eliminating poverty in our own time. With the fear of economic instability receding as our determination and capacity to control it grows, there has been increasing interest in this process of economic growth.

The current concern of public authorities with the problem of growth in this country is a relatively recent development. In the White Paper on Employment of 1945, 1/ which charted the course of postwar economic policy, economic growth received scant attention. Although growth was mentioned on occasion in official pronouncements, it is fair to say that, prior to the appointment of the Royal Commission on Canada's Economic Prospects in 1955, the Canadian Government had not developed a set of policies to promote economic growth, nor was it particularly concerned with the issue. Even the terms

of reference of that Commission 2/ revealed a passive attitude toward growth; it was instructed to report on Canada's future prospects and examine their consequences rather than investigate ways to improve the prospects. In sharp contrast, the terms of reference of the Royal Commission on Taxation call specifically for it to examine the effects of taxation upon economic growth. 3/

What accounts for this change of emphasis? The new interest in economic growth in Canada must be viewed as part of a growing North American concern about the issue. This growing concern had two roots. First, the rate of growth of output in North America definitely slowed down after 1957. This slower growth was accompanied by rising unemployment, and led to two kinds of policy recommendations. Some argued that only "rapid growth" could restore full employment, and we therefore needed to foster economic growth. Others interpreted the rising unemployment, and particularly the high unemployment in the cyclical peak year of 1960, as an indication of growing structural problems requiring specific remedies.

Second, other countries had achieved substantially higher growth rates than Canada or the United States throughout the 1950's, which increased our dissatisfaction with our own performance. More important, with the increasing share of world trade captured by the rapidly growing countries of Western Europe and Japan, the United States balance-of-payments position deteriorated, leading to fears that the competitive position of North America would be increasingly eroded unless positive action were taken.

We shall stress later our view that economic growth ought to be a government policy objective. However, we do not believe that the events described above can be corrected through growth policy. In fact, many of the prescriptions put forward for increasing the growth rate and the analyses upon which they are based are erroneous. An examination of these various positions

provides us with an excellent introduction to our own approach to growth.

It is obvious that, while an under-employed economy is returning to full employment, output must grow faster than normal while the unemployment is being reduced. To call this temporary process increased growth is to create confusion with respect to the comparisons of different periods (the late 1930's was a period of rapid growth in these terms), and may lead to mistaken policy conclusions, in the sense that special growth policies may be emphasized when they are not in fact required.

The way to eliminate excessive unemployment is to adopt policies to achieve full employment, not policies to increase the growth rate per se. In such a situation, what is needed is an expansion of aggregate demand without much concern for the composition of demand. By way of contrast, policies to increase the growth rate must focus upon changing the composition of demand in favour of investment and other future-oriented activities capable of either augmenting the supply of factors of production or their productivity.

Let us now turn briefly to the view that the increase in unemployment and worsened competitive position indicated the existence of a structural problem requiring remedies on the supply side of growth. In Chapter 7 of its Report, the Royal Commission on Taxation weighed the evidence bearing on the structural unemployment argument. The evidence is so overwhelming that they felt confident in rejecting the argument that increased structural problems led to the higher unemployment rates after 1957. The achievement of full employment in the past year confirms this view.

As for the erosion of our international competitive position, the decline in Canada's and North America's share in world trade can be viewed as a logical consequence of the recovery of the European nations and the

resumption of their full participation in an expanding world trade. The links between economic growth and increased competitiveness are tenuous in any case. The international competitive position of a country depends mainly upon the level of its prices and costs in relation to those of its competitors. Canada and other countries have achieved rapid economic growth accompanied by rising, falling, or stable price levels, depending largely upon the pressure of aggregate demand upon supply. It cannot be concluded, therefore, that an increase in growth will necessarily lead to either an improved or a worsened international competitive position. 4/

Before we proceed to the discussion of the growth objectives, it will be worth while to lay out our over-all conceptual view of the problem of economic growth, and to spell out the interrelationships between growth and stability. We view economic growth as an underlying, continuing process which, while subject to change over time, is not subject to erratic fluctuations. This naturally leads us to measure growth by the growth of the potential output of the economy, or its capacity to produce goods and services when all resources are fully employed. As Table II-5 following makes clear, for many periods the growth of actual output may differ significantly from growth as we have defined it, depending largely upon whether unemployment is rising or falling.

The problems of stability and growth are, however, interdependent. As we shall illustrate below, the level of potential output depends in part on the extent to which resources were utilized in the past. It follows that stabilization policy can make an important contribution to economic growth, even when that policy is not particularly growth-oriented. Furthermore, this contribution to economic growth is costless in the sense that present consumption or leisure or other goals need not be sacrificed in order to

achieve the increased growth. Finally, policies to increase the growth rate once full employment is achieved must influence the demand as well as the supply side of growth. An attempt to increase potential output without stimulating demand to increase realized output at the same time not only will create involuntary unemployment, but also may lead to a reduced rate of growth of that potential itself.

B. THE MEASUREMENT OF ECONOMIC GROWTH

1. The Three Growth Paths

As the goal of economic growth has come more and more into the forefront of public and private discussion on economic objectives, there has appeared simultaneously increasing confusion as to the appropriate concept of growth. To avoid this confusion, we propose to distinguish three basic types of growth in our subsequent analysis.

The first such concept may be referred to as actual growth, which is merely the record of past aggregate economic performance. This measure suffers from the serious weakness that observations at any point in time are particularly sensitive to the level of unemployment and to the phase of the business cycle. The actual growth rate derived between any two periods can as a result give a very distorted picture. For instance, if we examine the period 1933-57, we obtain an average annual growth rate of constant (1949) dollar GNP of 5.55%. If we choose a slightly different period, 1929-61, the rate is reduced by more than one third to 3.35% per year. The former growth rate is exaggerated because the initial year was particularly depressed while the terminal year was one of full capacity utilization of the factors of production. In contrast, the latter growth rate is from an initial peak to a terminal trough, biasing the rate downwards.

The second concept of growth, potential growth, overcomes this problem by adjusting each year's level of actual output for these departures from full capacity utilization. By calculating what output would be if the nation's resources were fully employed in that year, we in fact are measuring the growth of the economy's capacity to produce over time.

Finally, it is useful to consider a third concept of growth, the maintained full-employment growth path. This differs from potential growth in that the adjustment for unemployed resources in the potential growth concept fails to account for the effect of this year's unemployment on next year's supply of resources. For example, if a large component of the nation's capital equipment stood idle in a particular year, firms would tend not to add to their equipment, and capital would accumulate at a slower rate in the subsequent year, reducing thereby the level of potential output relative to what it would have been if capital accumulation had not been retarded. The potential measure thus treats bygones as bygones—the current losses in potential output as a result of the failure to use the full productive capacity of the economy in the past are, in effect, written off. The maintained full-employment growth path, in contrast, seeks to measure what the growth path would be if the system had not had any departures from full capacity utilization from the outset of the period. 5/ This final growth path will therefore be above the potential path realized in an economy which experiences periodic recessions. The latter will in turn be higher than the path of actual output during recessions and depressions, and below it during the war and immediate postwar years when the economy was operating under strong inflationary pressures.

2. The Interaction Between the Growth Paths

a) The Relation of Actual to Potential Growth

A traditional approach to these problems of variations in the degree of realization of potential has been to separate the analysis of fluctuations from the explanation of trends. Since the General Theory, a key role in the theory of fluctuations has been assigned to variations in aggregate demand. With a few exceptions, aggregate demand has not been assigned as important a role in theoretical analysis of economic growth. Most frequently growth has been treated as an essentially supply determined process. 6/

This partitioning is clearly valid only if the economy tends to fluctuate about its supply determined trend, or if stabilization policy is successful in ironing out major fluctuations—that is, if fiscal and monetary policies are used to supplement the weak automatic corrective mechanisms of changes in interest rates and price levels.

If neither condition holds, long-run growth will not be independent of the fluctuations that the economy experiences. Capital formation depends in part upon profit rates and the level of utilization of existing capacity. Prolonged periods of slack demand will retard the growth of this important input.

The growth of the labour supply is also hampered by slack demand conditions. Union and political pressures for shorter workweeks will intensify, and marginal workers will drop out of the labour force when unemployment is high. Furthermore, in an open economy, emigration will be encouraged and immigration discouraged by the slack demand. Some of these losses can be regained quickly when demand recovers, others can be recaptured more slowly, still others can never be recouped.

The process of technical advance itself is likely to be slowed under conditions of slack demand. The introduction of some cost-reducing process

innovations will be delayed. 7/ The introduction of new products will depend on the size of expected markets for these products; under boom conditions these expectations will be buoyant; if demand is stagnant, the introduction of new products will be a riskier undertaking. 8/ In addition, trade union resistance to labour-saving innovations will be great when labour is already extensively unemployed.

Finally, many processes of market adjustment will work less effectively under slack demand conditions. For example, the inter-industry and inter-regional mobility of resources will be lessened. As we shall demonstrate, shifts of resources between industries have been an important source of growth in the past.

These considerations, taken in conjunction with the observed fluctuations experienced by the Canadian economy over the past forty years, lead us to reject the traditional approach. Instead, we view the growth process as the outcome of the interaction between the growth of aggregate demand and the growth of aggregate supply. We therefore give some attention to the role played by fluctuations in demand in retarding growth in the past, as well as estimating the growth improvement that could be achieved through a more successful stabilization policy in the future.

This does not mean that we adopt the view that potential growth is largely demand-determined. While an increase in demand will raise the growth of potential GNP, it will provide a much greater stimulus to aggregate demand—via the multiplier-accelerator process. Hence a continued rise in demand can stimulate a high rate of growth of actual output only until excess capacity is exhausted. At that point, if inflation is to be avoided, the economy must content itself with the more modest gains from the effect of aggregate demand upon the growth of potential output.

To confuse the strong effect of demand on the growth of actual output under conditions of excess capacity with the modest effect of demand on the growth of potential output would be a more serious error than to ignore the impact of demand on potential output altogether.

The recognition that aggregate demand has an important effect on potential growth forces us to adopt a Keynesian view of savings and investment. Realized domestic savings and investment will typically be determined by the real investment decisions of firms. Only when the economy is at full employment (which occurred in well under half of the peacetime years covered by our analysis) is the national savings rate an important constraint on realized savings and investment. Even this constraint may derive more from the objectives of maintaining price stability and avoiding large balance-of-trade deficits than from the way the economy operates at full employment.

This means that a program aimed at enhancing growth through stimulating capital formation must give at least as much weight to the propensity to invest as to the propensity to save. Stimulating the latter without increasing the former would cause recessions, which in turn would frustrate the achievement of a higher growth rate.

This is important to keep in mind because an easy way of stimulating the savings rate is readily available—a general tax increase designed to raise the full-employment surplus. However, such a policy is a means to extra growth rather than to stagnation only if other policies—such as monetary policy—can be used to stimulate the propensity to invest. If monetary policy is either ineffective or constrained by balance-of-payments requirements, this tight fiscal policy, easy monetary policy road to increased economic growth will not be open. 9/

This points up the potential importance for the rate of economic growth of revisions in the tax structure and exchange-rate adjustments. The former may provide more direct means of stimulating the propensity to invest at full employment. The latter is a means both for increasing the national savings rate, and for providing an additional degree of policy freedom, thereby freeing monetary policy for the purposes of stimulating investment.

This Keynesian view of growth also has implications for increases in potential growth arising from an increased supply of labour or an increase in the pace of technical advance. Both present problems as well as opportunities. Unless aggregate demand grows at a sufficiently rapid rate, technical improvements will generate unemployment rather than more growth, and entrants to the labour force will also enter the pool of unemployed.

These problems are well illustrated by the 1956-63 period. Whereas the growth of both the capital stock and labour force were higher than their historical rates, thereby presenting the opportunity for a continuation of the rapid postwar expansion, aggregate demand grew at a rate insufficient to maintain full utilization of these resources. As a result, this period was one of extraordinarily bad actual growth performance in the light of the potentials that were open to us.

b) The Relation of Potential to Maintained Full-Employment Growth

The loss due to failure to maintain full employment may not be soon or easily recouped. Overcoming the retardation of the rate of capital formation during a prolonged recession requires years of steady full-employment growth. The retardation of the growth of the labour supply similarly takes time to recoup, and that portion due to retardation of net immigration may never be regained.

To illustrate this effect, in Chapter VI we calculate what the potential growth rate would have been in the past under conditions of continuous full employment, and contrast this with the growth of potential output actually achieved. The substantial difference revealed by these calculations points up the danger of adopting the neo-classical approach to economic growth. We also present projections of the growth of potential GNP under alternative policy assumptions. These projections indicate that the potential growth gain from maintenance of full employment in the future will probably outweigh whatever effects the tax reforms and the adoption of explicit supply-oriented policies are likely to achieve. While this result obviously depends on the assumptions we have made, we have leaned on the conservative side in evaluating the role of demand, since (a) technical change is projected exogenously, and (b) no allowance for inter-sectoral shifts within the private non-farm economy is made. As we have argued above, there is reason to believe that both of these factors will contribute more to growth under buoyant rather than stagnant demand conditions.

3. National and Domestic Concepts of Output

There are two concepts of gross output for the nation as a whole. 10/ Gross domestic product (GDP) measures the output produced by factors resident in Canada; gross national product (GNP) measures the output of factors of production owned by Canadian residents. The main difference is that GDP includes the interest and dividends paid to non-residents, and excludes dividends paid to Canadians by companies abroad; whereas GNP includes the latter but excludes the former.

Each concept has its uses. For example, GDP is the better measure for studies of the relationship between output, labour and capital input, and technology, because the productivity of a specific capital good is unlikely to be affected by the place of residence of its owner. Consequently, we use GDP within the private non-farm sector in estimating the aggregate production function (presented in the next chapter). However, from a public policy standpoint, the growth goal ought to be formulated in terms of GNP, which measures the income accruing to Canadian residents and therefore is a measure of the potential consumption available to Canadians. A policy which, other things being equal, raised the growth of GDP and lowered the growth of GNP is clearly not in the general interest of Canadians.

In most cases, however, policies which enhance the growth of GDP will also enhance the growth of GNP. For example, an increased rate of foreign investment will likely increase the growth rate of both measures. The growth of GDP will reflect the full incremental effect on output of the additional capital; the growth of GNP will be raised only by the proportion of that increment that is not remitted abroad.

There are, however, policies which expand the growth of GNP while not affecting the growth of GDP. If the gross investment rate of Canada is held constant, but the proportion financed abroad reduced, the growth of GNP will be increased while the growth of GDP will remain the same.

A capsule summary of the effects of different illustrative policies is as follows:

1. Policies that stimulate investment without affecting the relative importance of foreign savings in the financing of that investment will raise the growth rate of both measures.

2. Policies that stimulate foreign investment when that investment represents a net addition to total investment will raise both growth rates, but will raise the GDP growth rate by more than the GNP growth rate.

3. Policies that replace foreign savings with national savings, while holding investment constant, will stimulate the growth of GNP without affecting the growth of GDP. An example of such a set of policies would be a devaluation of the exchange rate coupled with a tax increase to raise the national savings rate.

4. Population Growth and the Growth of Per Capita GNP

Throughout this paper we shall focus upon the growth of total potential gross national product. This does not imply an indifference to the division of the growth between population growth and the growth of per capita GNP. Rather it reflects our belief that the two components of growth are not in conflict and may even be complementary in a geographically large but underpopulated country. 11/

The available evidence for the postwar period suggests that the productivity of immigrants has been somewhat higher on the average than that of the native born. In conjunction with the higher labour force participation rate of immigrants, this indicates that per capita GNP has been increased as a result of immigration since World War II.

Furthermore, the more rapid growth of markets and the more rapid growth of the labour supply will serve to encourage productive investment and to draw in foreign capital. To the extent that economies of scale remain to be reaped in some industries, the rate of growth of total factor productivity will be increased by this process.

Finally, in the long run, a larger population may permit economies in the use of public goods. However, this long-run advantage must be evaluated against the necessity to allocate more output to public investment in the shorter run.

We do not argue that there is no limit to the rate at which Canada could absorb new immigrants. Aside from the social problems involved, the marginal economic costs of absorbing large numbers of workers and of providing necessary social capital will likely increase as the rate of immigration rises. Furthermore, the influx of foreign capital that may be required to equip adequately the army of immigrants may be regarded as undesirable in itself.

These considerations will place an upper limit on the rate of immigration that is desirable in terms of economic objectives. Below that limit, per capita income growth and population growth will be complementary. If the rate of immigration at full employment is constrained below that limit by government policy, any retardation in immigration that accompanies a period of slack demand will dampen per capita as well as total potential growth.

C. GROWTH AS A GOAL OF ECONOMIC POLICY

1) In Defense of the Goal

Having defined what we mean by growth, we turn now to a consideration of growth as an economic objective. There is a body of opinion that argues that the growth achieved by an economy reflects the wishes of its members, and that tampering with policy to alter the rate of growth is a distortion of these preferences.

This view presumes that the markets in the economy are operating so as to assure the attainment of the optimal growth path from society's point of view. It appears to us that such a presumption is unwarranted. For example, there is no reason to believe that the level of investment, determined in the absence of government policies, will be optimal. 12/

In general, in the Canadian economy the operation of markets rather than the planning of governments determines the allocation of investment. To be sure, governments intervene in a number of ways and, as will be demonstrated later, the tax system has important effects upon the allocation achieved through the market. But by and large, investment decisions remain largely decentralized decisions.

As a point of departure, it is worth examining whether the operation of markets to co-ordinate the decentralized decisions of private firms and individuals will achieve or come close to achieving the optimal allocation of savings.

Under competitive market conditions, marginal private rates of return will be equated for investments of similar risk. Private rates of return will be higher, the riskier is the investment, due to a premium demanded by investors who seek to avert risk.

Even under these idealized conditions, market allocation will not be optimal since external benefits—which are likely to be important for investment which discovers or embodies new technology or for large lumpy investment projects which have significant effects on related industries—do not enter private calculations of profit and loss. Similarly external costs are also ignored. Even where external effects (whether positive or negative) are absent, marginal rates of return are not equated because

of the premium required for riskier investments. The risk premium appropriate for the individual firm is not appropriate for society as a whole because of the implicit pooling of risks. The appropriate social risk premium will therefore be much less than the private risk premium.

In this idealized world, then, market allocation will depart from the optimum. In addition, there are certain aspects of existing commodity and capital markets which further distort the allocation of capital away from the optimum. These are as follows:

1. The widespread existence of oligopoly in Canadian industry. Where the discipline of competitive markets is weak, investment may be restricted below optimal levels. In a situation in which market power both exists and is exploited, the marginal private rate of return will be below the social rate, since the firm will take into account any reduction in profits on its intra-marginal investments.

2. Capital market imperfections. Lenders' risk rises as the debt/equity ratio of the firm increases, and the terms on which credit is available become necessarily more stringent as the firm increases its borrowing. The amount of funds to which the firm will have access at a given rate of interest is therefore limited. Beyond that point, the marginal cost of borrowed funds will rise, and certain types of credit may not be available at all.

The availability of equity capital is also restricted. Issue costs and tax disadvantages preclude extensive use of new equity issues; as a result firms will resort to these issues only rarely when the rate of return on investment is unusually high.

The terms on which credit is available will therefore vary with the

demand for credit by the firm, and the marginal rate of return to firms in tight credit situations must necessarily be higher than the marginal rates of return to firms in easy credit situations.

The existing capital markets have a number of additional discriminatory features which further distort the allocation of investment. Since financial institutions generally have high risk aversion, the terms on which credit is available—if it is available at all—to new, small and other riskier enterprises is likely to be stringent. Furthermore, the market attaches liquidity premia to securities which are readily marketable. This will also tend to favour the large and well-established firms. These discriminatory features of the capital market are mitigated to some extent when firms use internal rather than external sources of funds. In fact, internal sources—capital consumption allowances and retentions from profits—have provided the bulk of investment funds in the postwar period. However, the use of internal funds itself poses serious allocation problems. Investment should be determined on the basis of marginal rates of return, not on the basis of past or present profits. Even in diversified firms, many investment projects will lie outside the view of even the most far-sighted manager. New firms and firms in growth industries must resort to external sources of finance—that is, they must turn to the capital markets. But there, as we have argued above, they will be unlikely to have access to sufficient funds at competitive rates.

The presumption that other private markets will achieve optimal resource use may be questioned as well. Consider first the labour markets where the exploitation of market power on both sides of the market could result in an inefficient and hence suboptimal allocation of the labour force between industries and occupations. In addition, the social barriers

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to labour force mobility which result from discrimination distort this allocation further.

As for the use of resources to attain the optimal level of technical advance, there is reason to believe that private markets work least efficiently here. The externalities involved in education will lead to private underinvestment in this area. The same holds for private investment in research and development, where the high private risks of innovation lead to even greater relative underinvestment.

Since private markets do not achieve optimal resource use, there is a case for government policies to improve allocation. To this, we might add the point that most government policies adopted for other purposes do affect the growth rate.

We have stressed that stabilization policy affects the rate of growth. Other policies are in potential conflict with growth. For example, attempts to achieve regional economic balance might reduce the growth performance of the economy as a whole. Similarly, the vague, but no doubt effective, constraints on the level of immigration have led to a suboptimal inflow of immigrants and hence a slower rate of growth.

To refuse to recognize that growth is a legitimate economic policy objective is to discount both these significant side effects of government policy and the inadequate allocation of resources to future oriented activities achieved by private markets. Once both of these factors are taken into account, there is no reason to omit growth from the spectrum of economic goals.

This does not mean that the government should necessarily select a target rate of economic growth much above the present rate of growth of potential GNP. There are costless ways of raising the growth rate by maintaining full utilization of labour and capital and by adopting a tax structure designed to improve the allocation of capital. To go beyond these involves explicit costs, such as reducing current public and private consumption, reducing leisure, weakening the income redistributive effects of the tax system, or increasing the use of foreign-owned capital. Whether additional growth is desirable depends on the relative evaluation of the social benefits of the additional growth against the social costs in terms of these other objectives.

2) The Impact of Taxes on Market Efficiency

Since we are primarily concerned with taxation, it is useful to examine the impact of the present tax structure on the allocation of resources. As far as tax policy is concerned, the fact that private markets do not achieve an optimum allocation of savings is an argument against neutrality.

While a case can be made for a non-neutral tax structure on these grounds, it does not follow, of course, that any non-neutral tax structure will improve the allocation of capital. A non-neutral tax structure may worsen rather than correct the allocation achieved by markets.

The present tax structure introduces a number of distortions which do not compensate for market distortions. In some cases the tax distortions worsen market distortions already present; in other cases they represent new distortions which further reduce the efficiency with which savings are utilized in investment.

There is no need to review every detail of the existing tax structure which affects the allocation of capital. Instead, we shall enumerate the more important features. These are as follows:

1. The inadequate allowance for the deduction of losses. This is a particularly serious distortion, as it lowers the expected after-tax rate of return on risky investments, which already suffer discrimination in the capital markets.

2. The dual rate on the corporate tax. This raises the after-tax marginal rate of return to small firms, and is an intra-marginal subsidy to larger firms. The first bracket rate may partly correct for the unavailability of funds to small businesses; however, it does not discriminate between small firms with pressing investment needs and small firms without. It is therefore an inefficient way of compensating for any capital market discrmination against small firms.

3. The separate corporate tax itself. The subjection of corporate source income to tax rates higher than those imposed on non-corporate source income will reduce investment in industries where corporate forms of organization predominate relative to investment in industries dominated by individual proprietorships and partnerships.

4. The absence of a tax on capital gains. In part, but only in part, this feature compensates for the existence of a separate corporate tax. However, the combination of the present corporate tax with no tax on capital gains on shares distorts investment in favour of activities which generate income in the form of capital gains relative to activities which generate income in the form of dividends. The absence of a tax on gains from the sale of other assets—particularly real

estate—also stimulates a shift of capital funds toward certain activities.

5. Various special industry privileges. A number of industries—mining, petroleum extraction and refining, certain financial institutions—are favoured under the present tax laws. This favourable treatment stimulates investment in these industries. Capital will shift into these activities until the marginal after-tax rate of return is the same in these industries as in industries of comparable risk. When this occurs, the before-tax marginal rates of return will, of course, diverge.

These features of the tax structure will reduce the rate of growth achievable with a given volume of savings by encouraging an inefficient allocation of the savings between alternative investment uses. Other features of the tax system may reduce the rate of growth by lowering the volume of savings. The corporate income tax may reduce corporate savings and deter investment; high rates of tax on higher income individuals will bear upon personal savings. Heavy reliance upon income taxes, rather than expenditure taxes, increases the tax burden upon savings relative to consumption. In addition, high marginal rates of income taxation may encourage emigration of professional and technical workers, and may encourage some substitution of leisure for work. 13/

Unlike the features of the existing tax structure enumerated above, the burden of taxation upon savings and effort is inherent in a system which relies heavily upon a progressive income tax. This means that the attempt to achieve income redistribution may involve some reduction in savings rates and hence in the rate of economic growth. Under these circumstances, it may

be rational for the government to adopt other policies to further economic growth—for example, by pursuing a more restrictive fiscal policy combined with a more expansionary monetary policy.

The next chapter focuses upon the measurement of the relative contribution to economic growth made by the growth in the supply of labour, technical changes, and capital formation, including an analysis of the effects of the movements of resources between broad sectors of the economy and a comparison with the United States economy. Chapters III to V examine the determinants of each of these three factors in turn. Chapter VI assesses the impact of aggregate demand upon the growth of potential GNP. Projections of the future growth of potential GNP under three sets of assumptions are presented in order to illustrate the effects of alternative policies upon growth. Chapter VII examines the effect of taxation upon economic growth. Finally, Chapter VIII provides an overview of the study as a whole and a comparison with earlier studies of the Canadian economy.

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1/ Employment and Income, Ottawa, King's Printer, 1945.

2/ Final Report Royal Commission on Canada's Economic Prospects, Ottawa: Queen's Printer, Appendix A pp. 471-2.

3/ Among other things, the Royal Commission on Taxation was instructed "to consider and report upon... b) the effects of the tax system on employment, living standards, savings and investment, industrial productivity, and economic stability and growth..." Report of the Royal Commission on Taxation, Ottawa: Queen's Printer, 1967, Vol. 1, p. v.

4/ By a worsened competitive position, we mean an increase in the deficit in the trade account at the prevailing level of the exchange rate. The possible effect of an increase in the potential rate of growth on the balance of payments is examined in Chapter VIII below.

5/ This path differs from the "steady state" equilibrium path referred to in the theoretical literature on economic growth and discussed and estimated in Chapter II of this study.

An economy is defined to be in a steady state equilibrium growth path if output and capital are growing steadily at the same rate. The maintained full-employment path defined above will be a steady state equilibrium path if: a) the capital/output ratio was in equilibrium at the start of the period, and b) the growth of the labour supply and technical change proceed at steady rates. If one of these conditions is not met, the full-employment path will not be a steady state equilibrium growth path.

6/ For a thorough survey of the theoretical literature on economic growth and a discussion of the properties of alternative growth models, see F.H. Hahn and R.C.O. Matthews, "The Theory of Economic Growth: A Survey", Economic Journal, Dec. 1964, pp. 779-902.

Actually, most of the theoretical models of growth may be divided into demand models, which emphasize the stability properties of the growth path of actual output, and supply-oriented models which focus upon the growth path of the economy under conditions of full employment. Examples of the former include the early studies of Harrod (R. F. Harrod, "Towards a More Dynamic Economics", Macmillan, 1949) and Domar (E. D. Domar, Essays on the Theory of Economic Growth, Oxford University Press, 1957, Chs. IV and V) and the model developed by Duesenberry (J. S. Duesenberry, Business Cycles and Economic Growth, McGraw-Hill, 1958, pp. 179-239).

The supply-oriented approach is exemplified in the classic articles of R. M. Solow (R. M. Solow, "A Contribution to the Theory of Economic Growth", Quarterly Journal of Economics, Feb. 1956, pp. 65-94; and "Technical Change and the Aggregate Production Function", Review of Economics and Statistics, November 1957, pp. 312-320).

(continued)

6/ (continued)

Few attempts at integration have been carried out in the theoretical literature. See, however, the model of inflation and growth developed by Kaldor (N. Kaldor, "Economic Growth and the Problem of Inflation", Economica XXVI, 1959, pp. 212-226, pp. 287-298).

In an important recent article, Tobin has developed a model demonstrating that the behaviour of the money supply is important for long-run growth as well as for short-run fluctuations (J. Tobin, "Money and Economic Growth", Econometrica, October 1965, pp. 671-684).

In contrast to the theoretical literature, recent empirical studies in the United States and Canada have assigned greater weight to the influence of aggregate demand upon the growth of potential output. (James W. Knowles and Charles B. Warden, "The Potential Economic Growth in the United States", Study Paper No. 20, Joint Economic Committee, Study of Employment Growth and Price Levels, U. S. Government Printing Office, 1960; E. F. Denison, The Sources of Economic Growth in the United States, Committee for Economic Development, 1962, Ch. 25; L. C. Thurow and L. D. Taylor, "The Interaction Between the Actual and Potential Rates of Growth", Review of Economics and Statistics, November 1966, pp. 351-360; T. M. Brown, Canadian Economic Growth, a study prepared for the Royal Commission on Health Services, Ottawa: Queen's Printer, 1964, Ch. 4).

7/ Under conditions of excess capacity a new plant will be constructed only if the average costs of production with the new plant are below the marginal cost of production in existing plants.

8/ For an analysis of a variety of evidence at the industry level which suggests that innovation responds to demand, see J. Schmookler, Invention and Economic Growth, Harvard University Press, 1966, pp. 104-164.

9/ The use of a restrictive fiscal policy combined with an expansionary monetary policy to increase realized savings and investment is discussed by Tobin. (James Tobin, National Economic Policy, Yale University Press, 1966, Ch. 8).

10/ Ideally, output net of economic depreciation should be used. However, existing measures of depreciation in the national accounts are quite tenuous, as they are based largely on capital consumption allowances reported for tax purposes. We therefore use gross output measures.

11/ See also R. E. Caves, "Policies for Economic Growth in Canada", in T. N. Brewis, et al, Growth & The Canadian Economy, Carleton University, 1965, Ch. VIII. For the opposite viewpoint, see J. H. Dales, "The Cost of Protectionism with High International Mobility of Factors", Canadian Journal of Economics and Political Science, Nov. 1964, pp. 512-525.

12/ For an elegant discussion of this question, see James Tobin, "Economic Growth as an Objective of Government Policy", American Economic Association Proceedings, May 1964, pp. 1-20.

13/ The available survey evidence on this question is surprisingly consistent, and indicates that the effect of taxation upon effort is quite weak. (See R. Barlow, H. E. Brazer and J. N. Morgan, Economic Behavior of the Affluent, Ch. X, The Brookings Institution, Washington, 1966, and references cited there.) However, the surveys deal with the effects of taxation under a tax system where loopholes and preferential rates vitiate the effect of marginal income tax rates. Under an effective progressive tax on comprehensive income as defined by the Royal Commission on Taxation, an increase in progressivity might be expected to have a somewhat stronger effect on effort.

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CHAPTER II: THE SOURCES OF ECONOMIC GROWTH

A. THE CONCEPT OF POTENTIAL OUTPUT

We have argued above that economic growth is best measured by the growth of potential GNP. Closing any gap between actual output and potential output is clearly the job of stabilization policy, and is best not confused with the problem of raising the growth of potential itself, although, as we have argued above and shall demonstrate below, the existence of a gap will affect the future growth of potential output.

Potential output is not the maximum output which the economy is capable of producing. Like the individual firm, the economy as a whole can produce, and has produced, for short periods at a rate higher than could be sustained over longer periods. The individual firm can operate at more than 100% of its capacity by incurring sharply increasing unit costs. Similarly, the economy as a whole can operate beyond its "capacity" or potential through the use of overtime work, by drawing in marginal members of the labour force, and by insufficient provision for the maintenance of equipment. If this happens there will be inflationary increases in costs. Levels of output near the technological maximum have only occurred during the war and immediate postwar periods when the economy was operating under forced draft conditions.

Potential output is the level of output achievable with full employment of labour, 1/ given the existing capital stock and the state of technology, after any short-run adjustments have been worked out. Hence the specification of potential output requires the specification of a target unemployment rate. As the Royal Commission on Taxation selected a target

rate of 3.5%, we have constructed estimates of potential GNP which correspond to the achievement of that unemployment rate. 2/ It is worth emphasizing that as potential output is determined by existing resources and technology, it is therefore not independent of the extent to which potential output has been realized in the past. Potential output indicates what is achievable without excessive demand inflation in the year under consideration, not what might have been achievable had the past record of the growth of demand and supply been different. The estimates of potential GNP which we shall discuss and use are therefore based on the assumption that "bygones are bygones".

In the remainder of this section, we shall briefly discuss the measurement of potential output. Later in this study we shall examine the extent to which changes in fiscal, monetary and tax structure policies can influence the rate of growth of potential GNP. We shall both examine the past record and project potential GNP for future years under alternative policy assumptions.

B. MEASUREMENT OF POTENTIAL GNP

At the level of the individual firm (and industry) the maximum least cost level of output is conceptually unambiguous, though it may be difficult to measure. At the level of the whole economy, the concept of potential output is not unambiguous, since different levels of GNP are achievable with the same levels of input of labour, capital and other resources. Since the productivity of labour (in terms of real GNP) differs among industries, the distribution of the final output must also be specified before potential GNP can be measured. Such a detailed specification is not feasible within our limitations of time and resources. Even if satisfactory specifications were possible, the measurement of potential output would require adequate production functions relating output to input.

A more aggregative approach is feasible if either of the following assumptions may be made:

(a) the distribution of output has not and will not change significantly; or

(b) the marginal productivity of the inputs would not differ very much in different sectors.

It is clear that neither of these conditions is met for the Canadian economy as a whole. However, we believe that they are approximately met for the private non-farm non-residential (PNF) sector of the economy. Government employment has been growing and is expected to continue growing faster than total employment; the reverse is true for agricultural employment. Average productivity of labour is relatively high in government, but relatively low in agriculture. Residential rents depend largely on the stock of residential capital, with a relatively minor contribution from labour. Consequently, a substantial improvement in the measurement of potential GNP will be achieved if we separate these three sectors from the rest of the economy. 3/

Whether further disaggregation of the PNF sector would yield improved estimates is doubtful. Both inter-sectoral movements and relative productivity differentials have shown less variability within the private non-farm sector than between it and the other two sectors. 4/

The disaggregation we have adopted has a cost; the relative importance of each of the four types of output must be specified in order to measure the aggregate potential output level. We shall treat output in government and agriculture and real residential rents as exogenous. This means that the level of these three outputs at full employment in any year is set equal

to the actual level achieved in that year. Employment in agriculture and government is treated in the same way.

Is this procedure valid? While these outputs are not wholly independent of the rate of utilization in the economy as a whole, they are largely determined by other factors. For government, policies adopted for reasons other than economic stabilization are most important in determining the level of gross domestic product originating in government (although stabilization policies may be important for expenditures and taxation). In agriculture, the importance of export markets, the low income elasticity of demand for many products, and the pervasive influence of the weather, all tend to insulate the level of agriculture output from the general level of business activity, especially during the same year. Residential rents, being largely a function of the existing housing stock, are not significantly affected by changes in the general level of activity over short periods.

Since the level of government, agricultural and residential output is predetermined, the critical problem is the measurement of potential output in the private non-farm non-residential sector. There are a variety of ways of measuring potential output. 5/ We have chosen to use the production function technique. In any period, the level of output will depend upon the amount used of the various inputs or factors of production. The production function describes this relationship. Over time, output is a function of: (a) the levels of the inputs, (b) shifts in the production function, and (c) interactions between (a) and (b).

Ideally, all inputs should be specified. Such a specification would include various types of labour, of fixed capital, and of natural resources.

As a simplification, we shall assume that output is a function of two broad factors of production—labour and capital. Since neither of these factors is homogeneous, changes in the distribution of the specific inputs within each broad group will influence the level and growth of output, as will changes in the use of natural resources, such as land, timber and minerals. These effects will show up as shifts in our production function; a more detailed production function would, of course, take them into account directly.

We assume that the production function is of the classic Cobb-Douglas form. This production function has the following properties:

(a) There are constant returns to scale.

(b) The elasticity of substitution between capital and labour is unity.

In addition, we assume that shifts in the production function, which may be conveniently called "technical change", are neutral in their effect—that is, the marginal products of capital and labour are increased by the same relative amount; and that technical change is disembodied—that is, the shifts occur regardless of the rate of change in the two inputs. This means, for example, that a technological improvement does not require a new machine or a newly trained worker in order to be implemented.

We have tested each of these assumptions to determine whether they are quantitatively invalid, and have not found any statistical evidence to reject them. These tests are discussed in Section C below.

Potential output depends on the gross capital stock, full employment labour input, and technical change (which is represented by an exponential trend). Actual output will differ from potential output because of cyclical fluctuations and the effects of other omitted variables. In order to

estimate the coefficients of the production function from data on actual output, a cyclical variable must be introduced. 6/ The cyclical variable used is the ratio of actual to potential labour input, which depends on the unemployment rate and the ratio of actual to normal average weekly hours worked.

The details of the estimating procedures need not be described here (see Appendix A). The production function used in the estimation of the potential output series for the private non-farm non-residential sector is as follows:

$$\text{LnQ} = -0.5233 + .0197\text{T} + .315\text{LnK} + .685\text{LnLp} + \underset{(.0976)}{1.716\,\text{LnLa}} + \text{E} \qquad 7/$$

$$(R^2 = .980)$$

where:

Q = output
T = time
K = gross capital stock
Lp = potential labour input
La = actual labour input
E = random variable-relative portion of output unexplained by variables in the equation
Ln = symbol for natural logarithm, and

standard errors are in parentheses. The coefficients for capital and labour are based on estimated relative income shares, and are therefore constrained in the regression analysis.

This production function can be used in various ways to derive estimates of potential output. The method we have used is the trend method which is based on the assumption that technical change is a smooth exponential function of time and that the E variable represents the residual cyclical and other short-run random influences. In this method, the following relationship is used to estimate potential output:

$$\text{LnP} = -0.5233 + .0197\text{T} + .315\text{LnK} + .685\text{LnLp}$$

where P is potential output.

From these estimates total potential GNP estimates may be obtained by adding in the output of the agricultural, government and residential sectors, and making adjustments to convert the estimates from a domestic factor cost basis to a national market price basis. 8/

The potential GNP series so derived is presented in Table II-1, together with actual GNP and the percentage gap between actual and potential. Actual and potential GNP are plotted in Chart II-1.

C. TESTS OF HYPOTHESES UNDERLYING THE ESTIMATION OF POTENTIAL GNP

1. Constant Returns to Scale

The strong collinearity among the three long-run variables—L_p, K, and T—leads to highly unstable and unreasonable estimates if a completely unconstrained regression function is fitted, as the result obtained in the following equation indicates:

$$\underset{}{\text{LnQ}} = \underset{}{8.7409} + \underset{(.0072)}{.0361T} + \underset{(0.16)}{1.4246}\ \text{Ln}\left(\frac{La}{Lp}\right)$$

$$+ \underset{(0.19)}{.6188}\ \text{LnK} - \underset{(0.65)}{.7256}\ \text{LnLp} \qquad R^2 = .993 \qquad DW = .98$$

The negative coefficient on the Lp variable is clearly unacceptable, and the time trend and capital coefficients appear to be unreasonably large.

A different approach to the economies of scale question is therefore tried. The relative importance of the capital and labour coefficient is constrained by the relative income shares. The coefficient on the weighted sum of the labour and capital variables then indicates whether economies or diseconomies of scale are important.

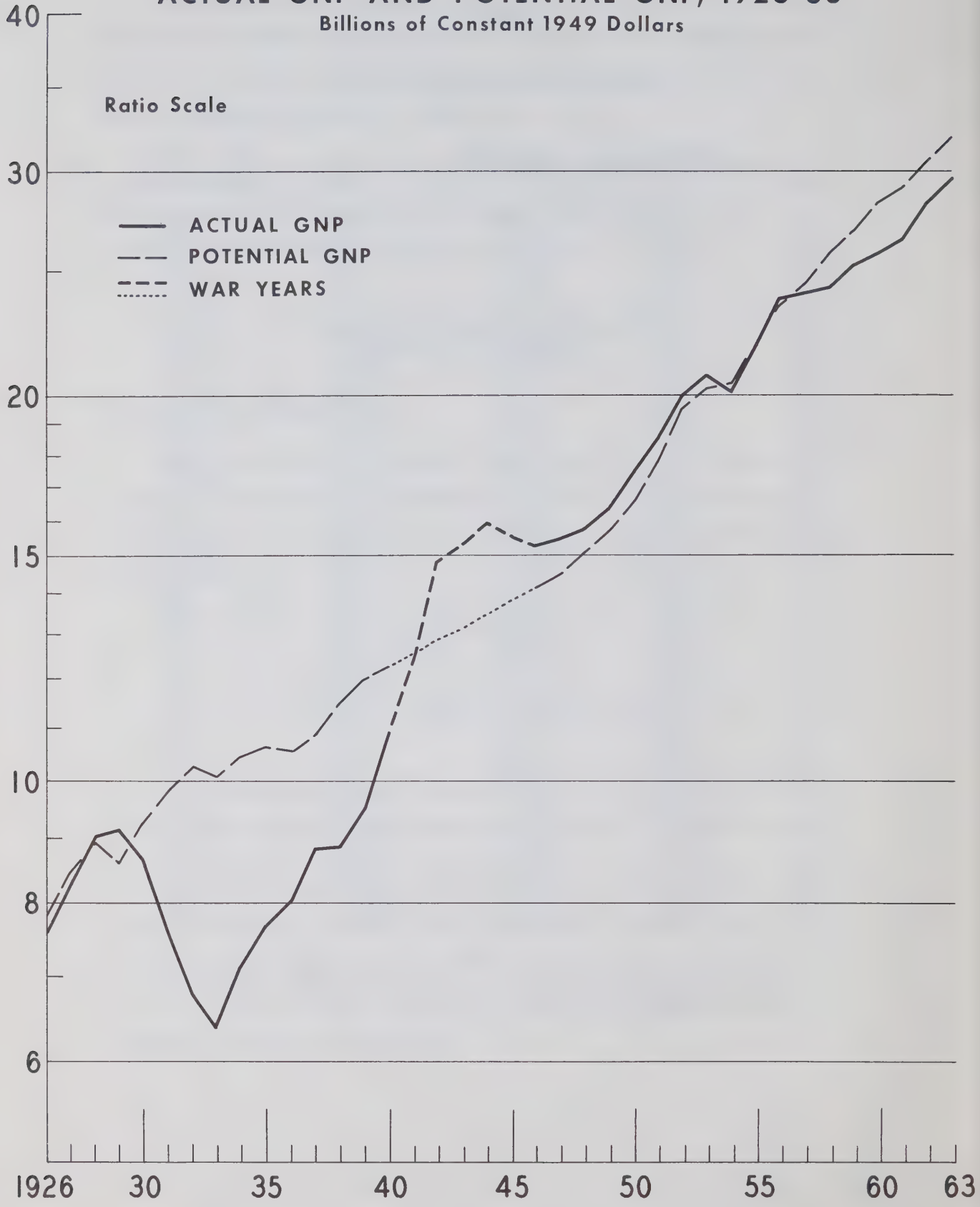
TABLE II-1

ACTUAL GNP POTENTIAL GNP AND THE GAP

Year	Potential GNP (Millions of Constant 1949 Dollars)	Actual GNP (Millions of Constant 1949 Dollars)	GAP	GAP as % of Potential GNP
1926	7,806	7,576	-230	-2.95
1927	8,470	8,270	-200	-2.36
1928	8,920	9,037	117	1.31
1929	8,591	9,061	470	5.47
1930	9,249	8,679	-570	-6.16
1931	9,826	7,567	-2,259	-22.99
1932	10,258	6,798	-3,460	-33.73
1933	10,062	6,359	-3,703	-36.80
1934	10,424	7,127	-3,297	-31.63
1935	10,603	7,678	-2,925	-27.59
1936	10,559	8,022	-2,537	-24.03
1937	10,887	8,820	-2,067	-18.99
1938	11,464	8,871	-2,593	-22.62
1939	12,003	9,536	-2,467	-20.55
1940	12,288 *	10,911	-1,377 *	-11.21 *
1941	12,579 *	12,486	-93 *	-0.74 *
1942	12,877 *	14,816	1,939 *	15.06 *
1943	13,182 *	15,357	2,175 *	16.05 *
1944	13,494 *	15,927	2,433 *	18.03 *
1945	13,814 *	15,552	1,738 *	12.58 *
1946	14,141 *	15,251	1,110 *	7.85 *
1947	14,479	15,446	967	6.68
1948	15,054	15,735	681	4.52
1949	15,640	16,343	703	4.49
1950	16,579	17,471	892	5.38
1951	17,772	18,547	775	4.36
1952	19,591	20,027	436	2.23
1953	20,279	20,794	515	2.54
1954	20,440	20,186	-254	-1.24
1955	21,951	21,920	-31	-0.14
1956	23,521	23,811	290	1.23
1957	24,464	24,117	-347	-1.42
1958	25,904	24,397	-1,507	-5.82
1959	26,935	25,242	-1,693	-6.29
1960	28,314	25,849	-2,465	-8.71
1961	29,157	26,515	-2,642	-9.06
1962	30,436	28,275	-2,161	-7.10
1963	31,944	29,583	-2,361	-7.39

* Potential for 1940-1946 obtained by logarithmic interpretation between 1939 and 1947 values.

Chart II-1
ACTUAL GNP AND POTENTIAL GNP, 1926-63
Billions of Constant 1949 Dollars



The results of fitting such an equation are as follows:

$$\text{LnQ} = \underset{(0.0041)}{1.4519} + \underset{(0.11)}{0.0244}\text{T} + \underset{}{1.6613}\ \frac{\text{LnLa}}{\text{Lp}}$$

$$+ \underset{(0.19)}{0.7807}(0.685\ \text{LnLp} + 0.315\ \text{LnK}) \qquad R^2 = 0.992 \qquad \text{DW} = 0.94$$

As the coefficient on the weighted sum of the capital and labour inputs is not significantly different from unity, our assumption of constant returns to scale will therefore be maintained.

However, in view of the strong collinearity between the weighted sum of the inputs and the time trend (the simple correlation between the two variables is .96), this equation does not provide a powerful test for competing hypotheses. Indeed, by the usual statistical procedures, a range of parameters from .40, indicating severe diseconomies of scale, to 1.16, indicating fairly substantial economies of scale, cannot be rejected on the basis of these data.

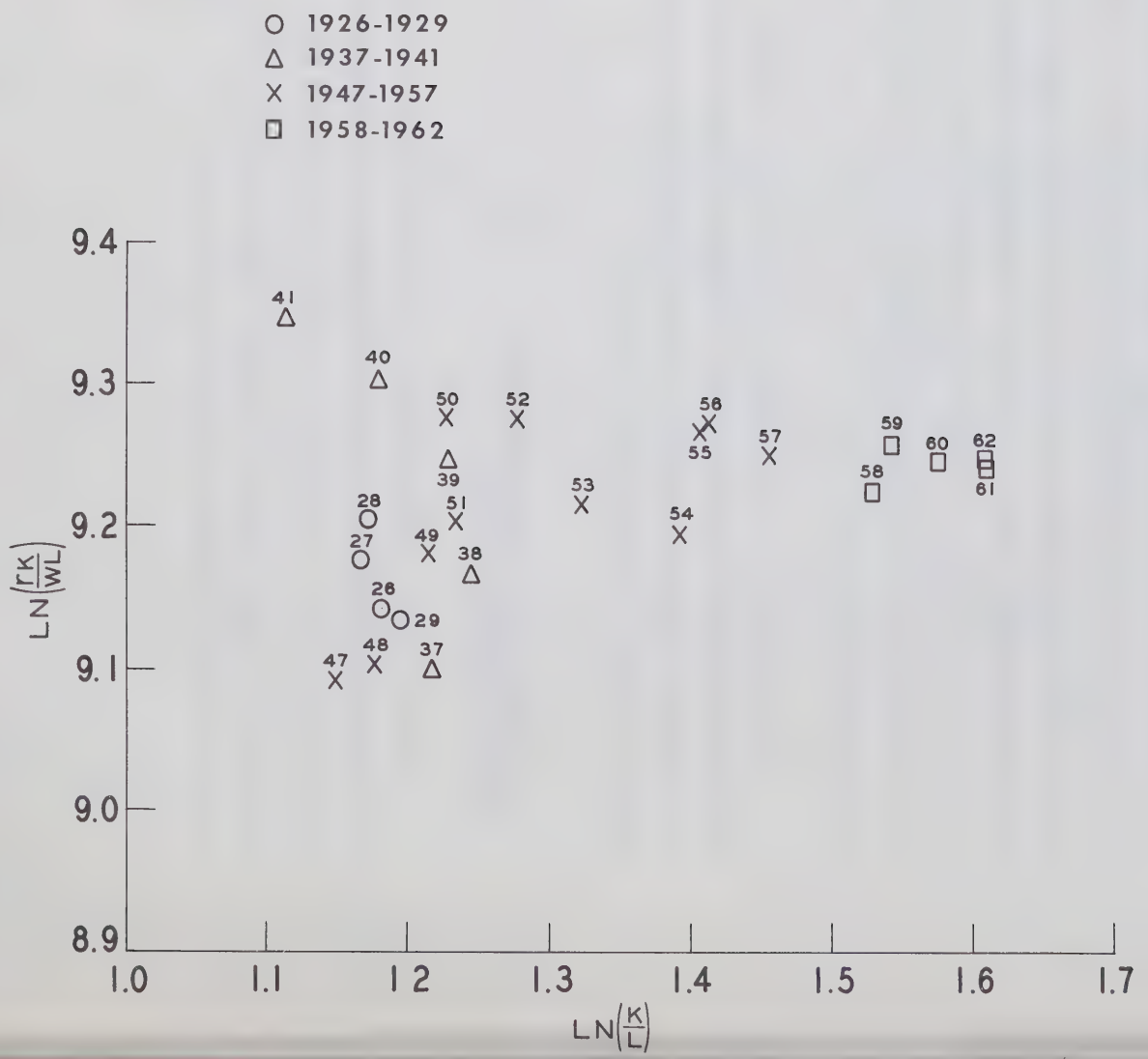
This question is not particularly serious for our purposes. Neither the estimated potential growth rate nor the estimated equilibrium growth rate (which is discussed in Section H below) would be affected much by moderate economies or diseconomies of scale. 9/

2. Unit Elasticity of Substitution and Neutral Technical Progress

Chart II-2 is a scatter diagram of the logarithm of the relative income shares of capital and labour plotted against the logarithm of the capital/labour ratio. The years of the great depression and World War II are omitted in order to reduce the impact of cyclical fluctuations. No significant slope or pattern is revealed in this chart.

Chart II-2

SCATTERGRAM - RELATIVE INCOME SHARES AGAINST CAPITAL LABOUR RATIOS



This result indicates that the data are consistent with the twin hypotheses of neutral technical progress and unit elasticity of substitution, provided that changes in factors payments reflect changes in their marginal products. Of course, alternative hypotheses involving combinations of non-neutral technical changes and departures from unit elasticity of substitution cannot be rejected either.

3. Technical Change is Disembodied

The age of the capital stock, the age of capital equipment, and the rate of change of the capital stock are introduced as additional explanatory variables in the production function; none of the variables is statistically significant.

We therefore make no attempt to adjust the capital stock to take into account the embodiment of new technology. 10/ The embodiment hypothesis has a great deal of intuitive appeal, and specific illustrations of embodiment abound. However, investment in new capital goods which are required to implement major innovations will have very high rates of return. Consequently, the introduction and diffusion of major technological improvements is unlikely to be delayed unless the rate of gross investment is very low.

The introduction and diffusion of more modest technological improvements which require embodiment in new capital goods is more likely to be delayed, but in such instances the embodiment effect will also be less important.

The results we obtain suggest that the historical variations in gross investment rates have not been large enough to affect noticeably the rate

of adoption of important new techniques. Any reduction in the rate of adoption of more modest improvements evidently has not had an effect strong enough to be detected in this highly aggregative analysis.

4. Contribution of Capital is measured by its Relative Share in Income

In order to test this hypothesis, a Cobb-Douglas production function with constant returns to scale, but without the restriction on the capital coefficient, is estimated. The results obtained are as follows:

$$\text{Ln}\frac{Q}{LP} = -.4726 + \underset{(.0019)}{.0196T} + \underset{(.108)}{1.87}\ \text{Ln}\left(\frac{La}{Lp}\right) + \underset{(.144)}{.272}\ \text{LN}\left(\frac{K}{Lp}\right). \qquad (R^2 = .98)$$

The estimated capital coefficient differs significantly from zero (on a one-tailed test) but does not differ significantly from the coefficient of 0.315 based on the relative shares. We shall therefore maintain the hypothesis that the relative contributions of the growth of capital and labour to growth are measured by their relative income shares.

D. RELATIVE CONTRIBUTIONS OF DIFFERENT FACTORS TO GROWTH

The model used in the estimation of the potential output series described above permits the estimation of the relative importance of the various determinants of the growth of actual and potential output. First, we examine the relative importance of labour input, capital input, and technical change as determinants of the growth of potential output in the PNF sector. Second, we develop similar estimates for the economy as a whole, making use of such data as is available for the other three sectors. Finally, we discuss the influence of the changes in the inter-sectoral composition of labour and capital that occurred.

The analysis in this section focuses on the whole period 1926 to 1963. 11/ In Section F below the importance of the different determinants of growth will be examined for the sub-periods, 1926-37, 1937-48, 1948-56 and 1956-63.

The production function

$$LnP = LnA + .315\ LnK + .685\ LnLP$$

implies the following growth equation:

$$\frac{\dot{P}}{P} = \frac{\dot{A}}{A} + .315\ \frac{\dot{K}}{K} + .685\ \frac{\dot{LP}}{LP}$$

where $\frac{\dot{A}}{A}$, $\frac{\dot{K}}{K}$ and $\frac{\dot{LP}}{LP}$ represent respectively technical change and the growth rates of capital and labour. This means that the growth of output is the sum of the rate of technical change and the growth of the inputs weighted by their marginal contributions to output. We can then compute the relative importance of technical change, capital and labour by dividing the contributions of each by the growth rate of potential output.

Table II-2 represents the results of this computation for the period 1926-63, together with the growth rates of actual and potential outputs. For this period, the growth of potential output was somewhat higher than the growth of actual output because of under-utilization in the terminal year. The over-all growth rate of potential private output was over 4% per annum; 46% of this growth was due to the growth of technical change; the growth of labour input accounted for about 31%, and the growth of capital input for about 23%.

While potential private non-farm output grew at 4.2% per annum, total potential GNP grew at only 3.8% per annum. The faster growth of the PNF sector reflected the fact that this sector benefited from the migration of labour out of agriculture, which will be analyzed below.

TABLE II-2

RELATIVE IMPORTANCE OF DIFFERENT SOURCES OF ECONOMIC GROWTH: PNF SECTOR 1926-63

	Potential Labour Supply	Capital Stock	Technical Change	Potential Output
Growth Rate	1.909	3.035	1.971	4.235
Point Contribution to Growth Rate	1.308	0.956	1.971	4.235
Percentage of Growth Accounted for	30.9	22.6	46.5	100.0

Only very crude estimates of the capital stocks are available for the other three sectors. Nevertheless, we thought it worth while to examine the relative importance of the three sources of growth for the economy as a whole. The results, tabulated in Table II-3(A), show a somewhat different picture from the analysis of the PNF sector above. Technical change is much more, and capital formation slightly more important, while the labour force growth is much less important as determinants of the growth of output for the economy as a whole, according to these aggregate estimates.

However, the aggregate estimates will be affected by changes in the inter-sectoral distribution of resources. These changes have a dual effect on total factor productivity. The outmovement of labour from agriculture tended to raise total output, since output per employee was higher in the non-agricultural sectors. However, the movement of labour also tended to reduce average hours worked, since the workweek in agriculture was longer than in industry.

In Table II-3(B) the growth of total output is reduced and the growth of labour input raised to take into account these effects of inter-sectoral shifts. When examined in the absence of the distorting effects of inter-sectoral labour and capital movements, the contribution of the three sources of growth for the economy as a whole is brought more closely in line with the estimates of the PNF sector.

Finally, a third approach involves the allocation of growth in each of the four sectors to the three sources. Government imputed rents and residential rents are allocated wholly to capital, and the remainder of government output to labour. PNF output and agricultural output are divided in accordance with the point contributions of labour and capital based on the relative shares of income in each of the sectors. The residuals in these sectors are then allocated to technical change.

The estimated percentage contribution of each of the three sources to aggregate growth are presented in Table II-3(C), together with the estimated point contributions to the aggregate growth rate implicit in these percentage distributions. As is clear, the estimated contribution of technical change is somewhat lower when this procedure is used.

In this approach, the estimated aggregate rate of technical change is a weighted average of the rates of technical change in the sectors, the weights depending on the relative importance of the sector at the outset and its rate of growth. In contrast, in the technique previously described, the divergent rates of growth of the individual sectors are not taken into account. Since the government sector, which had a zero rate of technical change (as a result of the way government output is measured), grew faster than the economy as a whole, the estimate of aggregate technical change obtained by the third technique is thereby reduced.

TABLE II-3

RELATIVE IMPORTANCE OF DIFFERENT SOURCES OF GROWTH: TOTAL ECONOMY
1926-63

	Labour Supply	Capital Stock	Technical Change	Potential GDP	Potential GNP
A. Aggregate Estimates					
Growth Rate	0.889	2.914	2.135	3.685	3.808
Point Contribution to Growth Rate (of GDP)	0.599	0.951	2.135	3.685	
Percentage of Growth Accounted for	16.3	25.8	57.9	100.0	
B. Aggregate Estimates Corrected for Inter-Sectoral Shifts					
Growth Rate	1.077	2.914			
Point Contribution to Growth Rate	0.725	0.951	1.897	3.573	
Percentage of Growth Accounted for	20.3	26.6	53.1	100.0	
Contribution of Inter-Sectoral Shifts	-0.126	—	0.238	0.112	
C. Aggregate Estimates Derived from Sectoral Estimates					
PNF Sector:					
Percentage of Growth Rate Accounted for	30.9	22.6	46.5	100.0	
Allocation of Change in Output ($M)*	5,852	4,276	8,817	18,946	
Agriculture:					
Growth Rate	-2.378	2.706		0.814	
Point Contribution to Growth Rate	-1.874	0.574	2.114	0.814	
Percentage of Growth Rate Accounted for	-230.2	70.5	259.7	100.0	
Allocation of Change in Output ($M)*	-1,409	431	1,589	612	
Government:					
Allocation of Change in Output ($M)*	1,055	127		1,182	
Residential:					
Allocation of Change in Output ($M)*		950		950	
Total Economy:					
Allocation of Change ($M)* in Output	5,498	5,784	10,406	21,688	
Percentage of Output Change Accounted for	25.4	26.7	48.0	100.0	
Implicit Point Contributions to Growth Rate	0.934	0.983	1.768	3.685	

* ($M) means in Millions of Dollars.

E. INTER-SECTORAL SHIFTS OF RESOURCES

In the light of the differences in the growth rates observed between the PNF sector and the economy as a whole for both output and input, it will be instructive to examine the importance of inter-sectoral shifts of resources in more detail.

A well known feature of economic growth in developed countries is the relative decline of the agricultural sector. Rapid productivity advance in agriculture, combined with the slower growth in the demand for the output of the sector, has led to a movement of labour from rural to urban areas of the country. We have developed two sets of estimates of the effect of the change in the composition of resources among these sectors. In the first approach, the growth of aggregate output per man is partitioned into between-sector and within-sector combinations according to the following formula:

$$\Delta\left(\frac{P}{L}\right) = \sum_i \left(\Delta\frac{Pi}{Li}\right)\left(\frac{Li}{L}\right)^0 + \sum_i \left(\Delta\frac{Li}{L}\right)\left(\frac{Pi}{L}\right)^1$$

where $\frac{P}{L}$ represents productivity, Δ represents the change over the period, superscripts 1 and 0 represent the end and the beginning of the period respectively, $\frac{Pi}{Li}$ represents average productivity in the i^{th} sector and $\frac{Li}{L}$ the average relative share of total employment in the i^{th} sector. 12/

The results of applying this method are presented in Table II-4(A). According to these estimates, 10% of the growth of output per man was due to inter-sectoral shifts. This would amount to 7% of the total change in output between 1926 and 1963.

It is clear that estimates obtained by this procedure are somewhat weak conceptually, since they assume that the marginal product of a worker

TABLE II-4

ALTERNATIVE ESTIMATES OF THE EFFECT OF INTER-SECTORAL SHIFTS

A. Contribution to Change in Total Output per Employee by Sector

Sector	Within Sector Change $(\Delta\frac{Pi}{Li})(\frac{Li}{L})$	Between Sector Change $(\Delta\frac{Li}{L})(\frac{Pi}{Li})$	Total Change
Agriculture	0.52	-0.63	-0.11
Government	-0.02	0.19	0.17
PNF	1.32	0.66	1.98
Total	1.82	0.22	2.04
% Distribution of Total	89.2%	10.8%	100.0%

B. Estimate Based on Production Functions and 1926 Distributions of Employment and Capital

	Potential Output					Output per Employee	Growth Rate
	PNF	Ag.	Res.	Govt.	Total		
Observed Change 1926-1963	18,946	612	950	1,182	21,690	2,390	3.685
Change with 1926 Distribution of Inputs	14,378	4,821	1,100	203	20,502	2,208	3.573
Effect of Inter-Sectoral Shift	4,568	-4,209	-150	979	1,188 (5.48%)	182 (7.62%)	0.112

moved into a sector is equal to the average product of workers already in the sector. Furthermore, these estimates take no account of changes in the distribution of the capital stock.

An alternative procedure is to make use of the estimated production function for the PNF sector. No production function has been estimated for agriculture; however, it will be assumed that a Cobb-Douglas production function based upon the estimated relative income shares is a good enough approximation. Residential rents and government imputed rents are assumed to vary proportionately with residential and government capital, and government labour income with government employment.

On the basis of these estimates and assumptions, 1963 potential output in each sector can be estimated for any assumed distribution of 1963 potential employment and capital. If employment and the capital stock are distributed among the sectors in accordance with the 1926 distribution of each of these inputs, the same resulting sectoral output estimates provide an estimate of what total potential output in 1963 would have been in the absence of inter-sectoral shifts. The difference between the observed growth rate of total potential output and the estimated growth rate in the absence of inter-sectoral shifts provides an estimate of the contribution made by inter-sectoral shifts to the growth rate.

The results are presented in Table II-4(B). Inter-sectoral changes in the distribution of labour and capital contributed .113 percentage points to the growth rate, thereby accounting for 5.5% of the change in total output and for 7.6% of the change in output per employee between 1926 and 1963. 13/ If allowance were made for diminishing returns in agriculture and for increasing returns in industry, as would be perhaps reasonable, the estimated

contributions would be larger. Consequently, these estimates are probably on the low side.

As was noted above, these inter-sectoral shifts have a stronger effect on total measured productivity because of the reduction in total man hours effected by the movement of labour from agriculture to industry and government. Taking into account both the increment to the growth of output and the reduction in total hours brought about by these inter-sectoral movements, they would account for .238 percentage points of the growth of total factor productivity at the aggregate level. This is roughly 11% of the growth rate of total factor productivity over the 1926-63 period.

F. ANALYSIS OF SUB-PERIODS

Whereas over the long period 1926-63 the growth of actual GNP was only slightly below the growth of potential GNP, for the various sub-periods more marked divergences appeared, reflecting, of course, the greater importance of changes in utilization over these seven to eleven year periods. (See Table II-5.) Over the 1926-37 period, for example, actual GNP grew at a rate less than one half the rate of growth of potential. This reflects the fact that 1937, although a cyclical "peak" year, was still a year of serious under-utilization of capital and labour.

Over the 1937-48 period, on the other hand, the rate of growth of actual GNP greatly surpassed that of potential, as the under-utilization at the start of the period was replaced by substantial over-utilization during the war, and moderate over-utilization remained at the end of the period. During the first half of the postwar period, actual output grew at a rate moderately below the growth of potential, as the over-utilization of the early postwar years and the Korean War period was eliminated. In the

TABLE II-5

GROWTH RATES* OF ACTUAL AND POTENTIAL OUTPUT
FOR SELECTED SUB-PERIODS, TOTAL ECONOMY

Period	GNP		GDP	
	Actual	Potential	Actual	Potential
1926-37	1.382	3.024	1.026	2.668
1937-48	5.262	2.946	5.202	2.885
1948-56	5.179	5.578	4.991	5.390
1956-63	3.101	4.373	3.276	4.594
1926-63	3.712	3.808	3.550	3.685

* As elsewhere in this study, growth rates are based on the continuous rate formula:

$$g = \frac{1}{T} \text{Ln} \left(\frac{X_T}{X_0}\right),$$

where g is the growth rate,

X_T is the value of the variable in the terminal year of a period,

X_0 is the value of the variable in the initial year of a period,

and T is the length of the period in years.

last part of the period a more substantial divergence appeared as the economy experienced growing under-utilization of resources arising from the recession of 1957-58, the abortive recovery and subsequent recession of 1959-60, and the delayed recovery in the following years.

As is shown in Table II-6, the growth of PNF potential output was retarded during the depression and the war. Capital formation was held at about half the historical rate (and about one third the rate achieved in the postwar

TABLE II-6

POTENTIAL OUTPUT GROWTH, THE SOURCES OF POTENTIAL OUTPUT GROWTH, AND THE GROWTH OF POTENTIAL EMPLOYMENT, SELECTED SUB-PERIODS

Period	Growth of Potential Output (GDP Basis)	Point Contribution to Growth Rate*			
		Labour Supply	Capital Stock	Technical Change** (inc. Effect of Inter-Sectoral Shifts)	Potential Employment or Labour Force
A. Total Economy					
1926-37	2.668	.877	.577	1.214	1.93
1937-48	2.885	-.127	.590	2.422	0.88
1948-56	5.390	.858	1.636	2.896	1.85
1956-63	4.594	1.007	1.335	2.252	2.18
1926-63	3.685	.599	.951	2.135	1.65
B. PNF Sector					
1926-37	3.943	1.493	.478	1.971	2.55
1937-48	2.964	.525	.467	1.971	1.65
1948-56	5.553	1.850	1.733	1.971	3.12
1956-63	5.186	1.626	1.589	1.971	2.79
1926-63	4.235	1.308	.956	1.971	2.45
C. Agriculture Sector					
1926-37	-2.224	-.095	.581	-2.710	0.95
1937-48	1.959	-2.109	.015	4.053	-1.82
1948-56	3.618	-3.073	1.529	5.162	-4.32
1956-63	.582	-2.927	.347	3.162	-2.71
1926-63	.814	-1.874	.574	2.114	-1.81

* Based on aggregate technique. See also Table II-3(A) and discussion in text.

** Technical change is assumed to proceed at a constant rate in the estimation of the production function.

period). The PNF labour supply continued to grow during the depression, but its subsequent growth was retarded.

The postwar period witnessed a much higher growth of potential output brought about by the strong growth of both capital and labour in the PNF sector. The greater growth of capital reflected the higher investment rates and higher utilization rates characteristic of periods of high employment. The rapid growth of the labour supply reflected both the higher net immigration rates and the more rapid outmovement of labour from agriculture.

Turning to the economy as a whole, we find a similar picture. Capital formation showed the effect of weak demand early in the depression and was retarded during the war. Total man hours were actually reduced between 1937 and 1948. During the depression, the outflow of labour from agriculture was halted; between 1926 and 1937 employment in agriculture actually increased nearly 1% per year.

The postwar period as a whole was one of rapid expansion of aggregate potential output, but the rate of growth in the second half fell short of the rate achieved in the first half of the period. This reflected a reduction in the rate of growth in the capital stock greater than that observed in the PNF sector, a slower rate of technical progress in agriculture, and the virtual elimination of the stimulus provided by inter-sectoral movements of labour. (See Table II-7.) Agricultural employment did continue to decline, albeit at a slower rate, but the past declines had reduced the relative importance of agriculture so that a given outflow of labour was an ever smaller percentage increment to the labour supply to the rest of the economy. Furthermore, the growth of productivity in agriculture had substantially reduced the productivity differential at the margin between this sector and

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TABLE II-7

EFFECT OF INTER-SECTORAL SHIFTS ON AGGREGATE TECHNICAL CHANGE (OR TOTAL FACTOR PRODUCTIVITY), SELECTED SUB-PERIODS

Period	Aggregate Rate of Technical Change	Effect of Inter-Sectoral Shifts *	Rate of Technical Change in Absence of Shifts
1926-37	1.214	.257	.957
1937-48	2.422	.353	2.069
1948-56	2.896	.363	2.533
1956-63	2.252	.001	2.251
1926-63	2.135	.238	1.897

* Effect of inter-sectoral shifts is measured as the difference between the growth rate of aggregate potential GNP and the growth rate estimated on the basis of the 1926 inter-sectoral distributions of employment and capital. See also Table II-3(B) above.

the rest of the economy. As a result, the reduction in hours worked brought about by movement of workers from agriculture to industry just about offset the increment achieved in output per man hour.

What emerges quite strikingly from this analysis is the influence of demand upon the growth of the two inputs. In the 1930's the rate of growth of capital was very low, and the rate of growth of potential labour input was retarded as the great depression delayed the outmovement of labour from agriculture and dried up immigration. During the war period, the growth of capital and labour continued to languish, largely as a result of wartime restrictions upon capital formation and immigration. In the post war periods both labour input and capital input grew very rapidly, but the growth was particularly rapid in the first half of the period when demand conditions were very strong.

G. COMPARISONS WITH THE UNITED STATES

Over the period from the 1920's to the mid-1950's, the Canadian economy achieved a growth rate substantially higher than that of the United States. In this section we compare the estimates of the point contributions of the different sources of economic growth presented earlier with estimates for the United States derived from the studies of Knowles and Warden, Denison, and Solow. 14/

The relevant comparisons at the aggregate level are presented in Table II-8. It is clear at a glance that the bulk of the difference of the growth rates of the two countries is accounted for by the more rapid growth of the factor inputs. Even if no correction is made for the effect of inter-sectoral shifts, estimated technical change only accounted for a modest share of the difference in the observed growth rates.

TABLE II-8

THE SOURCES OF ECONOMIC GROWTH:
COMPARISONS WITH ESTIMATES FOR THE UNITED STATES

		United States	
	Canada 1926-63	Knowles 1929-57	Denison 1929-57
Inc. Inter-sectoral Shifts			
Capital	.951	.622*	.43
Labour	.599	.367	.47**
Technical Change	2.135	2.095	2.03
Exc. Inter-sectoral Shifts			
Capital	.951	.622*	.43
Labour	.725	.367+	.47+ **
Technical Change	1.897	2.035	1.96
Inter-sectoral Shifts	.238	.060	.07***
Total Growth	3.685 (GDP) 3.808 (GNP)	3.084	2.93

* Includes effect of age of the capital stock.

** Quantity effect only.

*** Sum of inter-sectoral shift and elimination of waste in agriculture.

\+ In the United States, average hours worked in agriculture are not very different from average hours worked in industry. No adjustment was therefore made to labour input to allow for the effect of inter-sectoral shifts.

Once allowance is made for the effect of inter-sectoral shifts—which are more important in Canada than in the United States—the estimate of the rate of technical change in Canada is slightly below that of the United States. However, a comparison of the estimated rate of technical change in the PNF sector in Canada with an estimate for the private non-farm economy in the United States derived from a study by Solow 15/ indicates the opposite. Solow's published series shows technical change proceeding at 1.84% per year over the period 1929-49, a rate slightly below the rate of 1.97% estimated for Canada.

We therefore conclude that total factor productivity, as conventionally measured, grew at about the same rate in the two countries and that the bulk of the difference between the observed growth rates is due to the higher growth of the inputs of labour and capital, and to the greater importance of inter-sectoral shifts in Canada.

This greater importance of capital is reasonable in the light of observed investment rates in the two countries which are tabulated in Table II-9. In 1929 total fixed investment was 16.7% of GNP in Canada and 12% in the United States. During the 1930's the average investment rate in the United States was 7% whereas in Canada during the same period it was 8%. During World War II, United States investment continued to lag behind Canadian investment, being only 5.6% in comparison with 7.6%. In the postwar period, while the United States investment rate rose substantially relative to its earlier levels, it remained roughly one third below the rate achieved in Canada.

This finding that the higher growth rate in Canada results wholly from the higher growth of the factors of production is somewhat disturbing. The more rapid rate of growth of the labour force in Canada reflects higher

TABLE II-9

BUSINESS FIXED INVESTMENT AS PER CENT OF GNP
IN THE UNITED STATES AND CANADA

Year	United States Investment Rates	Canada Investment Rates
1929	12.0	16.7
1930	10.9	14.3
1931	7.7	11.0
1932	5.3	6.2
1933	4.9	4.8
1934	5.5	5.4
1935	6.3	6.3
1936	7.5	7.4
1937	8.5	8.9
1938	6.6	8.4
1939	6.7	7.5
1940	7.7	9.0
1941	7.8	10.1
1942	3.9	8.1
1943	2.7	5.9
1944	3.4	5.3
1945	5.1	6.2
1946	8.9	8.8
1947	10.8	12.2
1948	10.8	13.5
1949	9.8	13.7
1950	9.7	13.4
1951	9.5	13.9
1952	8.9	14.2
1953	9.1	14.5
1954	8.9	13.8
1955	9.2	13.3
1956	9.7	15.9
1957	9.6	17.0
1958	8.6	13.7
1959	8.5	13.5
1960	8.9	13.2
1961	8.4	12.2
1962	8.6	11.9
1963	8.7	12.2
AVERAGES: 1930-39	7.0	8.0
1940-46	5.6	7.6
1947-63	9.3	13.7

Source: Canada - D.B.S. National Accounts, Income and Expenditure
Cat. No. 13-502, Table 5
Cat. No. 13-201, Table 56.

United States - Economic Report of the President, 1967,
Table B-2 (converted to 1949 dollars)

immigration rates as well as higher birth rates. While, as we have argued earlier, the increase in the labour supply may be somewhat complementary with the rise in per capita GNP, it is clear that the per capita growth gains from labour force expansion are limited.

The more rapid long-run growth rate of capital does make a contribution to the growth of per capita gross domestic product. However, a large portion of this growth has been financed by net capital inflows so that some portion of the fruits of growth generated by the growth of the capital stock must necessarily accrue to the non-resident owners of resident capital. Indeed, during the postwar period the capital formation financed by the capital inflow accounted for more than one half of the difference between the investment rate in Canada and that in the United States.

One might have expected a more rapid growth of total factor productivity in Canada, as a result of

(a) the greater potential for the exploitation of economies of scale via economic growth in a smaller economy, and

(b) the opportunity, implicit in the lower level of productivity in Canada, to adopt the more advanced techniques already in use in the United States.

However, there are some offsetting factors which have served to retard the growth of productivity in Canada relative to that in the United States. These are the slower growth in the level of education (or a lower rate of investment in human capital) and the lower relative level of spending on applied research and development. Each of these factors is discussed in Chapter IV below.

H. THE ESTIMATED EQUILIBRIUM GROWTH PATH

A one-sector economy may be defined to be growing along an equilibrium growth path if capital and output are growing at the same steady rate. If the PNF sector of the Canadian economy were considered in isolation, its equilibrium growth path would be 2.88% per year plus the rate of growth of the labour supply. 16/ Given the rate of growth of the labour supply in that sector over the period 1926-63, the growth rate of potential output achieved (4.24%) fell considerably short of the equilibrium rate of 4.79% for the sector.

In a multi-sectoral model, the precise estimation of the equilibrium path would require the allocation of capital formation to the different sectors under conditions of steady state growth. Having no basis to make this allocation, we shall use the aggregate estimates of total factor productivity to estimate the equilibrium growth path of total GDP under conditions of steady growth. This procedure yields an estimate of 3.17% plus the rate of growth of manhours. 17/ Given the rate of growth of manhours for the economy observed for the 1926-63 period, the equilibrium growth rate of total GDP would have been 4.06%, 0.37 percentage points above the growth of potential achieved.

Had a growth rate of 4.06% been achieved over the 1926-63 period, the effect on current GNP would be substantial. In 1963 (in current dollars), total potential GNP would be $4.7 billion higher or $248 for every person in Canada. We repeat that these figures probably understate the total impact of war, depression and recession on our past growth rate, since they make no allowance for the effect of achieving full employment upon the growth of the labour force or upon the pace of technical advance.

These results indicate that the growth of potential output was seriously retarded by the low capital formation during the depression and during the war. Despite the relatively high rates of capital formation that occurred in the postwar period, we have not yet made up the investment lost during the depression and the war. The capital stock today is substantially below what it would have been had equilibrium growth been achieved throughout the period. This result has the following implications:

(a) Our historical growth rates understate the rate that could be achieved if past rates of technical progress and of savings at full employment are maintained.

(b) In the absence of a major war, we can expect somewhat faster growth in the future than in the past if fiscal and monetary policy succeeds in keeping the economy close to full employment. A possible offset to these favourable developments is the possibility of inter-sectoral movements of labour being less favourable to growth in the future than they were in the past.

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REFERENCES

1/ While capital could be the limiting factor, this is unlikely in a developed economy except under extraordinary conditions.

2/ Actually, the "full employment" unemployment rate for the private non-farm labour force was specified to be 4%, which corresponds to an aggregate unemployment rate of about 3.5% in the postwar period.

3/ N. H. Lithwick has found that the movement of labour from agriculture to industry had an important effect upon aggregate output per manhour. (N. H. Lithwick, Economic Growth in Canada, pp. 21-36, University of Toronto Press, forthcoming Summer, 1967). See also Section E below.

4/ Lithwick also found that inter-sectoral movements between other sectors were relatively unimportant. (loc. cit.)

5/ For a discussion of the different techniques applied in the United States see Michael E. Levy, Fiscal Policy, Cycles and Growth, National Industrial Conference Board, Studies in Business Economics No. 81, 1963, pp. 59-81.

6/ These coefficients cannot be estimated from the relationship between actual output and actual labour and capital. In the short run, changes in output will lead to less than proportionate changes in labour input because some labour inputs are overhead inputs in the short run. Consequently, when the economy is operating above or below its potential output level, observed output will not lie on the long run production function.

7/ Note that $\text{Ln}(\frac{Q}{Lp}) - .315\ \text{Ln}(\frac{K}{Lp})$ is the dependent variable.

8/ As this equation for the PNF sector was fitted to the 1926-63 period excluding the years during and immediately following World War II (1940-46), the potential GNP series for those years is estimated by logarithmic interpolation.

9/ With constant returns to scale, the equilibrium growth rate of the PNF sector is 4.79% per year. The equation above indicating diseconomies of scale implies an equilibrium growth rate 0.10 percentage points lower. The effect of the existence of moderate economies of scale upon the alternative projections of potential GNP is discussed in Chapter VI.

10/ Examples of the empirical implementation of the embodiment hypothesis are provided by Solow and Thurow and Taylor. (R. M. Solow, "Technical Progress, Capital Formation and Economic Growth", American Economic Association Proceedings, May 1962, pp. 76-86, Thurow and Taylor, op. cit.)

11/ Calculations for the 1926-56 period reveal that the results are not very sensitive to the choice of the terminal year, which indicates the advantage of using potential rather than actual output as the basis of the calculations.

12/ The averages referred to are averages of beginning and end year values.

13/ The relative contribution of inter-sectoral shifts to the absolute change is larger than their relative contribution to the growth rate because of the cumulative (compound interest) effect of the higher growth rate.

14/ James W. Knowles and Charles B. Warden, "The Potential Growth in the United States", Study Paper No. 20, U. S. Congress, Joint Economic Committee, Study of Employment, Growth and Price Levels, U. S. Government Printing Office, 1960. Edward F. Denison, The Sources of Economic Growth in the United States, Committee for Economic Development, 1962. Robert M. Solow, "Technical Change and the Aggregate Production Function", Review of Economics and Statistics, November 1957, pp. 312-320.

15/ Series A_t in Solow, op. cit., Table 1, p. 315.

16/ This is obtained by solving the following equation for the equilibrium growth rate:

$$\frac{\dot{P}}{P} = .0197 + .315\frac{\dot{K}}{K} + .685\frac{\dot{L}p}{Lp} \quad ,$$

setting $\frac{\dot{K}}{K} = \frac{\dot{P}}{P}$.

17/ This is obtained by solving the following equation for the equilibrium growth rate:

$$\frac{\dot{P}_T}{P_T} = .02135 + .326\frac{\dot{K}_T}{K_T} + .674\frac{\dot{L}_T}{L_T} \quad ,$$

setting $\frac{\dot{K}_T}{K_T} = \frac{\dot{P}_T}{P_T}$.

CHAPTER III: THE SUPPLY OF LABOUR

We now turn to an examination of the factors which influence the growth of the labour supply, the rate of technical advance and the rate of capital formation. In this chapter we examine the determinants of the supply of labour, looking at demographic factors, immigration, emigration, labour force participation rates and average hours worked. Our hypotheses are presented and are then tested in Section D. In Chapter IV we examine the factors underlying the rate of technical change, paying particular attention to inter-sectoral movements of resources, education, and research and development. In Chapter V we assess the determinants of the realized rate of capital formation, which involves an analysis of the savings decisions of households and the investment and retention decisions of firms.

The potential supply of labour depends upon the rate and composition of population increase, upon the quality of the population, and upon the choice made by the population between work and leisure. The latter choice involves not only decisions about labour force participation but also decisions about hours worked.

A. DEMOGRAPHIC FACTORS

Economic theory, and in particular growth theory, has generally avoided the study of the influence of economic variables upon demographic patterns. Thus, despite the importance of the latter for economic growth, their determinants are assumed to be non-economic and they are constantly taken as exogenously determined. Similarly, only slightly more is known about the effect of economic variables upon the work-leisure choices of the population. While the income and substitution effects are capable of elegant theoretical formulation, very little has been done in the way of estimating

the direction and quantitative magnitude of these choices in the course of economic evolution in Canada.

We shall attempt to provide some preliminary estimates of the impact of these demographic variables.

Let us turn first to the growth of population, which can be partitioned into natural increase and net migration. Since these have rather different determinants and have a different impact upon growth, it will be useful to analyze them separately.

The rate of natural increase depends upon the birth rate and the death rate. In the early stages of modern economic growth there was a very strong relationship between economic progress and the decline in the death rate. However, in the last two or three decades declines in the death rate have been largely due to medical-technological advances, which are largely exogenous to the economic system.

As a result, over the past forty years rate of natural increase have generally varied with the birth rate. Up to World War II, it was assumed that the decline in the birth rate that resulted from the secularization and urbanization that accompanied industrialization and growth would be permanent. In contrast to the situation in an agricultural society, children could no longer be viewed as a form of investment, for they were prevented from joining the labour force at an early age, and in a highly mobile industrial society they could not be counted upon to channel future earnings to parents.

The postwar reversal of this decline in the birth rate in Canada upset these forecasts, and it appeared that there was a fundamental change in attitudes towards family formation. Some argue that children may be viewed as a form of consumer durable, 1/ and thus are a valid objective of consumer choice

in an age of high mass consumption. It was thought that the rise in the birth rates after World War II simply represented a return to normal after the prolonged period of depression and war, but the reversal of the trend in birth rates after 1960 to a historical low of 19.6 per thousand by 1966 suggests a much more complex demographic mechanism at work. 2/

As a result, we must, for the present, remain agnostic on the critical variables affecting the birth rate and hence the rate of natural increase.

TABLE III-1

DEMOGRAPHIC TRENDS IN CANADA, 1921-66

(Rates per 1,000 Population)

	Birth Rate	Death Rate	Natural Increase
1921-25	27.4	11.2	16.2
1926-30	24.1	11.1	13.0
1931-35	21.5	9.8	11.7
1936-40	20.5	9.8	10.7
1941-45	23.5	9.8	13.7
1946-50	27.4	9.3	18.1
1951-55	28.0	8.5	19.5
1956-60	27.6	8.0	19.6
1961-66	23.5	7.7	15.8

Source: D.B.S. Canada Year Book, 1955, Table 1, p. 189
1963-64, Table 1, p. 221
1966, Table 1, p. 244.

D.B.S. Canadian Statistical Review, January and March 1967, Tables 1, 4 and 5.

Migration has played an important but varying role in population increase in this century. The average contribution of net migration to total population increase for the whole period has been about 13%, but since World War II it has doubled in importance. Furthermore, these proportions understate the contribution of migration to total population increase because they omit the children born to immigrants in Canada.

Analysis of immigration reveals that the demand function for immigrants is highly specific, both as to skill qualifications and national origin. The former attributes are interpreted by immigration authorities as depending upon the number of positions vacant in Canada that are unlikely to be filled by Canadians, such as in teaching and in nursing. The rationale of past policy with respect to the quotas imposed on nationals of particular countries clearly did not involve the achievement of primarily economic objectives. The new White Paper on Immigration appears to have given much greater weight to these goals.

TABLE III-2

SOURCES OF POPULATION INCREASE, CANADA, 1921-61

(a) In millions

	Natural Increase	Immi-gration	Emi-gration	Gross Flow (to U.S.)	Net Migration	Total Increase
1921-31	1.36	1.20	-.97	(.95)	.23	1.59
1931-41	1.22	.15	-.24	(.16)	-.09	1.13
1941-51	1.97	.55	-.38	(.16)	.17	2.50
1951-61	3.15	1.54	-.46	(.40)	1.06	4.23

(b) As% of total increase

	Natural Increase	Immigration	Emigration	Net Migration
1921-31	85.5	75.5	-61.0	14.5
1931-41	108.0	13.3	-21.2	-7.9
1941-51	78.8	22.0	-15.2	6.8
1951-61	74.5	36.4	-10.9	25.5

Source: P. Camu, E. P. Weeks, Z. W. Sametz, Economic Geography of Canada, MacMillan, Toronto, 1964, Table 3:1, pp. 58-59 and Table 3:2, p. 60.

The immediate and obvious result of the constrained function of the past has been a sub-optimal inflow of immigrants, both because of imperfect recognition of vacancies by the authorities, and because of the automatic exclusion of skilled persons from countries that are discriminated against. Thus, although the demand for labour in Canada is the key economic variable operating upon the demand for immigrants, the impact of changes in the demand for labour upon immigration has been limited by these constraints.

The supply of persons desiring to come to Canada depends upon their relative standard of living as compared to ours, together with a variety of non-economic factors. Since almost all countries from which immigrants to Canada come have had substantially lower per capita real income than that which existed in Canada over the period, 3/ we would expect minor fluctuations in real income in Canada to have little effect in shifting this supply curve.

From the foregoing, we would expect the major explanatory variable of immigration to be the effectiveness of aggregate demand in Canada. This operates through the labour market, so that increased aggregate demand creates labour shortages which shifts the demand curve for immigrants to the right. 4/ Given substantial elasticity in the supply functions, as attested to by the large number of persons desiring to come at any time, the inflow of immigrants would expand accordingly. 5/

Net population increase is affected by the outflow of persons from Canada as well. Since most of this outflow has been destined to the United States, 6/ we shall concentrate on that particular movement.

The general view appears to be that the key determinant of this outflow is "employment conditions in the United States", although "there is no neat

and precise mathematical relationship between them." 7/ We attempted to test this view by correlating the emigration of Canadian workers to the United States as a proportion of the Canadian labour force with the unemployment rate in the United States. A variety of lags were used, with surprisingly consistent negative results. The evidence suggests that there is no significant relationship between emigration and United States employment conditions. Thus, changes in the demand for labour, which explain population movements into Canada, do not account for emigration from this country to the United States.

A variety of demand-type explanations for this emigration may be adduced. One is centered upon the higher standards of living in that country which serves to attract Canadians. This was tested by fitting emigration functions with the absolute level of real per capita consumption in the United States as the independent variable. The explanatory power of this variable turned out to be very small. A variant of this formulation claims that it is the relative standards of living in the two countries that is the key variable. Our test using real per capita consumption in the two countries again forced us to reject the hypothesis.

TABLE III-3

CORRELATION BETWEEN THE EMIGRATION OF WORKERS TO THE UNITED STATES AND U.S. UNEMPLOYMENT RATES 1948-62

Lag	Simple R^2
0 years	.001
1 year	.000
2 years	.043
3 years	.052

It was felt that perhaps the relative levels of total real consumption per capita are not accurate measures of this "demonstration effect". As an alternative, relative levels of per capita real durable consumption were used. Once again the relationship proved to be insignificant. As final indicators of the pull of the United States upon Canadians, the growth rate in the United States and the growth rate in that country relative to that of Canada were used, with no meaningful relationship found for either.

These very negative findings on the conventionally accepted explanations of the process of emigration led us to formulate an alternate, supply-oriented hypothesis. The higher absolute levels of per capita real income in the United States is assumed to exert a continuing pull upon Canadians. However, so long as this economy successfully utilizes its labour force, there is sufficient friction to overcome some of this attraction. During lapses in domestic aggregate demand, however, the weakening of the demand for labour will lower the real income of some persons significantly, the tension keeping workers here will relax, and emigration to the United States will speed up. 8/

B. THE DECISION TO WORK

The decision to work has two aspects: participation in the labour force and the number of hours per year that are worked.

There has been a surprising constancy in the participation rate for the labour force as a whole. This stability results from two factors. The first is the great stability in the participation rate of primary members of the labour force, namely, men aged 20-64. Since this group has accounted for nearly two-thirds of the Canadian labour force, 9/ the stability in their

rate has dominated the over-all rate. In addition, offsetting trends in participation rates among the marginal groups have helped maintain this over-all stability. The trends for these groups must be explained for a fuller understanding of this process.

TABLE III-4

LABOUR FORCE PARTICIPATION RATES BY AGE AND SEX, CANADA, 1921-61

Age	1921	1931	1941	1951	1961
(a) Males					
14-19	60.0	51.1	48.7	48.8	40.8
20-24	92.3	92.6	91.5	92.3	95.0
25-34	96.2	97.7	97.7	96.4	98.2
35-64	94.3	95.8	95.2	93.2	95.0
65 & over	58.4	55.7	47.4	38.6	29.8
(b) Females					
14-19	23.9	21.5	21.9	31.4	32.1
20-24	35.0	42.3	41.8	46.8	50.5
25-34	18.1	21.7	24.8	24.2	28.6
35-64	10.7	12.0	13.7	19.6	29.6
65 & over	6.3	6.2	5.5	5.1	5.9
(c) Total					
14 & over	53.4	53.7	53.0	53.1	54.8

Source: Woods and Ostry, op. cit., Table XIX, p. 309.

There has been a sharp decline in participation rates for young people, especially males. This was due, decades ago, to legislation against child labour, but the critical variable now is the increased demand for education. School has become a more attractive alternative to work for these young people because of the high private rates of return to this form of investment 10/ which reflects a growing demand for educated persons in industry.

In addition, the recognition of the social benefits arising from education has led to the adoption of a variety of government policies designed to encourage education.

Short-run demand factors may also be important, for should young people find themselves unable to find jobs, they will likely remain in school. And this decision is not immediately reversible when demand recovers because of the high opportunity cost of not completing the year(s) of school. Hence, periods of high unemployment may be expected to accelerate the secular decline in participation rates.

The participation rates of persons over 65 years of age have also undergone a secular decline. This is due to an increasing relative supply of older workers, together with decreasing relative demand for their services. The former has been due to the secular increase in life expectancy, which has increased the proportion of older people in the population. In Canada this proportion has increased from under 5% in 1921 to over 7.5% in 1961, despite the unusually high proportion of young people in the population occasioned by the postwar baby boom.

In addition, the over-all demand for older workers has declined, largely because of the declining relative importance of agriculture as the economy advanced. 11/ Agriculture has always employed a larger proportion of older workers than industry and the decline in its relative importance in the total economy has consequently reduced the demand for these workers. This has been partially offset by an increased use of these workers relative to other workers in agriculture as well as in services. The remaining industries, largely because of the obsolescence of older workers' skills and their inability to adapt to a rapidly changing technical environment, have reduced

their demand for these workers. As a result of these offsetting changes, the intra-industry use of older workers has increased very slightly, while the aggregate use declined because of the decline of agriculture.

These two trends, the increasing supply of older people and the weakening demand for them, have been re-enforced by the development of pensions and retirement savings plans. Since for older persons leisure through retirement is an alternative to work, this increased use of pension and saving plans, by increasing the attractiveness of leisure, has speeded up their rate of departure from the labour force. During periods of unemployment this trend would accelerate and, as the departure of an older individual from the labour force is largely irreversible, the historical data reveal a sharp, steady downward trend in their participation rates.

The behaviour of the participation rates of women between the ages of 20 and 65 is more difficult to explain. It is evident from Table III-4 that their participation rate has increased rapidly. That this supply has been largely composed of married women can be seen by noting that between 1946 and 1960 more than 80% of the 536,000 females who entered the Canadian labour force were married women. 12/ Long explains a parallel trend observed in the United States from the supply side. 13/ The increasing supply of these females has resulted from the greater freedom from household duties occasioned by new housekeeping aids and smaller family units. In addition, the secular decline in average hours worked per week has made full-time work for married women more feasible. 14/

The demand for female workers has been generally attributed to their lower unit costs because of the widespread discrimination against women. Also, they have become increasingly better educated and thus are being

substituted for the older and younger male workers. To support this substitution hypothesis, the constancy in the over-all participation rate is cited by Long. 15/ Further examination of the data, however, suggests that the shift of demand from agricultural output to that of services contributed to the increase in the demand for female workers. If we take the period 1921-61 as a whole, there is only partial support for this position as can be seen in Table III-5.

TABLE III-5

CHANGING INDUSTRIAL DISTRIBUTION OF FEMALE WORKERS, AGES 20-64, 1921-61

Industry	Share in Total Labour Force		Proportion of Females 20-64 in Each Industry	
	1921	1961	1921	1961
Agriculture	32.8	9.9	1.3	11.0
Services	13.3	27.0	42.0	40.1
Rest	53.9	63.1	10.0	17.7
TOTAL	100.0	100.0	11.4	23.1

Source: Census of Canada, 1931, Vol. VII, Tables 6 and 7, pp. 8-11.
1961, Vol. III, Part 2, Table 9.

The doubling of the total proportion of females has been due about equally to intra-industry increases in the proportion of females hired in all industries except services and to the reduction of employment in agriculture which has a relatively low proportion of females among its employees.

Within the long period, there was a discrete change during the war years, which saw a sharp rise in the proportion of females in agriculture. 16/ During the postwar period the rise in the proportion of female employees is wholly attributable to inter-industry shifts, particularly the shift toward service-type industries. Table III-6 presents the evidence for this period.

The intra-industry change alone in the proportion of females hired would have actually reduced the proportion of women in the total labour force. It has been the shift away from agriculture and toward the service industries with their much higher proportion of female employees that has been the key factor in increasing the demand for women during the postwar years.

TABLE III-6

CHANGING INDUSTRIAL DISTRIBUTION OF FEMALE WORKERS, ALL AGES, 1946-60

Industry	Share in Total Labour Force		Proportion of Females in Each Industry	
	1946	1960	1946	1960
Agriculture	25.4%	11.3%	13.2%	7.3%
Manufacturing	26.0	24.7	20.6	20.6
Transportation & Utilities	8.1	8.6	12.1	13.9
Trade	12.3	16.5	34.0	31.9
Finance, Insurance & Real Estate	2.6	3.8	39.6	47.5
Services	16.8	24.6	45.1	50.2
Other	8.8	10.5	1.6	2.6
TOTAL	100.0	100.0	22.7	26.6

Source: D.B.S., Canada Year Book, 1961, Table 4, pp. 731-2.

With the supply of females rising as a result of the factors suggested by Long, and with changes in industrial structure leading to a secular rise in the demand for their services, we would expect the participation rate of females to increase rapidly.

To summarize, the explanation of the trends in participation rates must be examined within a dynamic, economy-wide framework. The mechanism by which changes in participation rates occur is the secular rise and relative decline of various industries. 17/

Agriculture, which can use the young and the uneducated as well as older persons has declined in importance, so that an increasing proportion of these groups in the population cannot find jobs and eventually leave the labour force for the alternatives of school or retirement. The displacement of agriculture by the newer industries, particularly services, has been important in leading to a rise in participation by females. These are mostly married women who have more education than either the old or the very youngest members of the labour force. As a result, they are more adaptable to the changing skill requirements in these new, rapidly expanding industries.

These changes in the composition of the demand for labour brought about by changes in the composition of industrial employment were complemented by changes in the composition of the supply of labour resulting from the mechanization of the household, the increased demand for education, and the increased provision of pension and retirement benefits. While the aggregate demand variable which we use to explain migration would be an important factor here, we have found it more useful to consider the individual demand variables for each type of worker because of structural differences.

There has been little variation in the participation rates of men 20-64 over the long run. This is not surprising, since for most of them there is no alternative to working as a means of acquiring income and fulfilling their roles as breadwinners, and consequently they are unlikely to leave the labour force.

C. AVERAGE HOURS WORKED

Between the mid-20's and the mid-50's, average hours worked per year declined 22%. 18/ This decline is composed of a twofold reduction: reducing the number of weeks worked per year through longer vacations, and

reducing the average number of hours worked per week. The former has thus far been relatively less significant; a two and one-half week reduction in the total year constitutes only a 5% reduction in labour time. 19/

Thus, the major portion of reduction of hours that occurred between 1926 and 1963 has been due to a decline in the average number of hours worked per week. Some of this is explained once again by the exit of labour from agriculture, as can be seen in Table III-7.

TABLE III-7

AVERAGE HOURS WORKED PER WEEK, CANADA

	1926	1956
Agriculture	64.0	55.3
Non-Agriculture	49.8	41.3
Total Economy	54.8	43.2

Source: N. H. Lithwick, Economic Growth in Canada, unpublished Ph. D. Dissertation, Harvard, 1963, Table A-8, p. 160.

While the shift out of agriculture, where average hours worked are high, has reduced the number of hours worked per week in the total economy, the downward trends within industries have also been strong.

The important issue here is the extent to which the secular decline in hours has reflected the voluntary choosing of greater leisure by members of the labour force, and the extent to which it has reflected a secular weakening in the demand for labour, either from technological change which substitutes capital for labour, or through insufficient aggregate demand. In either of these cases the response of labour would be to press for a reduction in the number of hours in order to share the work. 20/ It is likely that these

forces have been interdependent; it will therefore be difficult to disentangle their relative importance. A model incorporating a trend and the unemployment rate explains most of the variability in average hours worked. 21/ However, statistical tests 22/ reveal that the aggregate demand variable offers a particularly powerful explanation of these trends as well.

D. QUANTITATIVE ANALYSIS OF THE DETERMINANTS OF LABOUR SUPPLY

In this section, various hypotheses about the supply functions of labour are tested. In addition to the variables already discussed, tax variables are also introduced in order to assess the effect of taxes upon these labour supply functions.

Because of various practical problems, we must underline the tentativeness of our findings. First, any far-reaching analysis of labour force trends should consider all relevant variables. Furthermore, non-economic factors are no doubt among the variables relevant for some of the demographic patterns. As the number of variables that can be meaningfully included in an aggregative annual time series equation is limited, the investigation is confined to the key economic variables.

Secondly, some of the data are available only for the years since World War II, which hinders an analysis of secular trends. However, it is possible to assess the importance of moderate changes in demand and of tax changes using these data.

The tax that bears most heavily upon the long-run supply of labour is the personal income tax. This tax has two components: the rate structure of taxes levied upon taxable income, and the level of exemptions on personal income which are deducted to arrive at taxable income.

In selecting tax variables for the estimation of the functional relationships, it is better to use statutory rates because realized effective tax rates may be affected by cyclical and secular changes in income. The tax rates used are derived from the tax schedules published in Taxation Statistics. The tax rate variable, which reflects both general rate increases and the progressivity of the rate structure, is obtained by weighting the various published rates of tax on taxable income by the number of taxpayers in the relevant taxable income brackets up to $10,000. This covers over 98% of all taxpayers and avoids the variability caused by the small numbers of taxpayers and the wide ranges in the upper income brackets. We are thereby able to derive an average statutory tax rate on taxable income for each year from 1946 through 1961. The exemption series is the value of total potential exemptions allowed within the personal income tax on a per capita basis. 23/

Statistical Results

1. Natural Increase

If children can be conceived of as a form of durable consumer good, then changes in the levels of exemptions would alter the price relationship between children and other durables. On the other hand, there is no reason to expect changes in tax rates to affect the birth rate significantly, for they would operate as changes in disposable income and would be distributed over the entire consumption package sought by individuals. As we have stated in Section A, we have no reason a priori to include any economic variable as a major determinant of the birth rate.

Simple statistical tests of the relationships between the birth rate and the tax variables offers little support for these hypotheses. No

meaningful relationship was found between the crude fertility rate and the tax rate; the correlation between the birth rate and the level of exemptions is positive but statistically insignificant.

We therefore conclude that the impact of past changes in taxation on the growth of population through natural increase has been negligible.

2. Migration

Our analysis suggests that the major economic factor affecting immigration to Canada is the pressure of aggregate demand upon the capacity of the economy operating through labour markets. To test this hypothesis, as well as to evaluate explicitly the role of taxes in immigration, we estimate the following function for the years 1947-62. The lags have been derived empirically here, as in all our subsequent equations. Shorter and longer lags yield less strong relationships, although the demand variable remains marginally significant.

Equation 3-1 24/

$$\frac{F}{P_{c_t}} = -.029432 + \underset{(4.21)}{.000774}\, D_{-1} + \underset{(0.59)}{.000287}\, T_{-3} + \underset{(1.97)}{.000050}\, E_{-2}$$

$$\bar{R}^2 = .58 \quad (F = 4.67)$$

Sest = .0025 DW = 2.14

Variables:

F	-	Total number of immigrants
P_c	-	Canadian population
D	-	Demand variable—ratio of actual to potential output
T	-	Tax rate variable
E	-	Exemption variable
Sest	-	Standard error of estimate
DW	-	Durbin-Watson statistic

Figures in parentheses are t tests of the regression coefficients.

The tax rate variable is found to play an insignificant role in immigration, but the level of exemptions has a moderately favourable effect.

The hypothesis about the role of demand is strongly confirmed. Failure to maintain demand at capacity levels in the short run will have a direct impact on immigration and thereby on the long-run growth of the nation's labour supply.

As for emigration, it is useful to examine two pieces of evidence, the first dealing with the emigration of workers and the second with total emigration. Only emigration to the United States is considered.

Equation 3-2

$$\frac{W}{Lc_t} = +.005065 - \underset{(5.16)}{.000154}\, D_{-2} + \underset{(4.01)}{.000300}\, T_t - \underset{(2.95)}{.000007}\, E_t$$

$\bar{R}^2 = .79$ $\quad (F = 11.49)$

Sest = .00032 $\quad$ DW - 1.55

Variables:

W - Number of Canadian workers emigrating to the United States
Lc - Canadian labour force

Equation 3-3

$$\frac{Pa}{Pc_t} = .002154 - \underset{(2.97)}{.00066}\, D_{-3} + \underset{(2.89)}{.000159}\, T_{-1} - \underset{(1.60)}{.000003}\, E_{-1}$$

$\bar{R}^2 = .60$ $\quad (F = 4.54)$

Sest = .00024 $\quad$ DW = 0.80

Variables:

Pa - Total number of Canadians emigrating to the United States.

In both models, the demand variable signifying the push of workers to the United States is significant. In addition, the tax variable is very important for worker emigration, and slightly weaker for total emigration.

Once again the level of exemptions is unimportant. Thus, our hypothesis as to the mechanism of emigration to the United States is borne out by the aggregate data.

The fact that tax rates in Canada affect emigration but not immigration deserves some discussion. First, the difference in after-tax income between Canada and the home country may be sufficiently large that variations in tax rates do not have much effect. Secondly, as the immigrant may expect a lower money income during his first years in Canada, exemption levels may be more important than tax rates. Recall that the exemption variable is of marginal importance in the immigration equation. Finally, tax rates are a more important consideration for middle income professional people who represent a relatively large proportion of emigrants.

One other point of interest that emerges from these models concerns the difference in the lag relationship of the variables. The direct impact of downward shifts in aggregate demand relative to potential output, as well as increases in tax rates, is upon working members of the family who are usually family heads. As they respond to these forces by moving south of the border, some time lapse will occur before dependants can follow. This is due to the necessity to secure new jobs, living accommodations, and because children in school likely remain to complete the school year. As a result, the arrival of dependants is delayed, making total emigration in response to these changes more remote. This is clearly evident in equation 3-3, where the coefficients are all lagged one year more than in equation 3-2, and where the t values indicate that they are all less significant statistically.

The statistical findings below also provide an alternative mechanism to explain the now famous "displacement theory". This theory is based on the observed correlation between population inflows and emigration to the United States, and suggests that the result of immigration is a lowering of real incomes and hence a push of workers to the United States. 25/ In contrast to the supply-orientation of that model, our findings suggest that the interaction between demand and supply explains the short lag in immigration and the longer one in emigration, yielding the observed systematic relationship between the two.

How important have these tax changes been? From equation 3-3 we calculate that over the period 1948-60, about 63,750 Canadian workers emigrated in response to tax rate increases above the 1948 level. This is over one quarter of the total number of workers emigrating over this period. If tax rates had not risen as they did, we estimate that the labour force in 1960 would have been larger by approximately this number of workers. This would have raised the growth rate of labour input by 4% thereby raising the potential growth rate in Canada by about .04 percentage points over that period.

While the impact of the personal income tax upon the growth of the working population has been found to operate only upon emigration, the foregoing analysis has revealed the very strong dependence of both migration variables upon the strength of aggregate demand of the Canadian economy.

This means that a failure to maintain high levels of capacity utilization will have substantial long-run effects, through the reduction of population growth and the potential labour supply. This operates on both sides of the vice, by reducing immigration and stepping up emigration.

3. Participation

We proceed to test the hypotheses presented earlier about participation rates by reference to the postwar data, including both tax variables in each equation estimated. For the participation rates of persons over 65, equation 3-4 is established.

Equation 3-4 26/

$$R^{O}_{t} = \underset{}{18.2336} + \underset{(10.26)}{0.4434}\ A_{-2} - \underset{(3.96)}{0.5284}\ T_{t} + \underset{(0.42)}{0.0017}\ E_{t}$$

$\bar{R}^2 = .95$ (F = 62.15)

Sest = .555 (DW = 2.07)

Variables:

R^{O} - Participation rates for persons over 65
A - Share of the labour force in agriculture

Thus, the decline in agriculture has had a significant direct effect upon the participation rate of older workers. In addition, tax increases have accelerated their departure from the labour force.

To explain the participation rates of younger members of the labour force, between the ages of 14 and 19, equation 3-5 was fitted.

Equation 3-5

$$R^{Y}_{t} = \underset{}{47.7746} - \underset{(13.02)}{0.4334}\ H_{-2} - \underset{(1.29)}{0.2540}\ T_{t} + \underset{(0.87)}{0.0172}\ E_{t}$$

$\bar{R}^2 = .92$ (F = 30.52)

Sest = .744 DW = 1.88

Variables:

R_t^Y - Participation rates, 14-19 year olds.

$H_{1947/8}$ - Total high school enrolment, academic year 1947-48 divided by the average population ages 14-19 for the same two years.

Neither of the tax variables are significant, but the schooling variable has a dominant effect.

Finally, equation 3-6 examines the factors influencing the participation rates of females.

Equation 3-6

$$R_t^f = 3.5057 + \underset{(18.74)}{1.33655}\, S_{-2} - \underset{(2.54)}{0.2692}\, T_t + \underset{(0.47)}{0.0016}\, E_t$$

$$\bar{R}_c^2 = .97 \qquad (F = 98.64)$$

$$\text{Sest} = .455 \qquad DW = 1.24$$

Variables:

R_t^f - Participation rates for females 20-64

S - Share of services in the labour force

For females, the tax rate variable is significant at the 95% level of confidence, and the shift to services serves to explain most adequately the increase in female participation rates.

We conclude that the hypotheses presented earlier about the trends in the participation rates of workers are not refuted by the statistical evidence. On the contrary, the role of inter-industry shifts appears to be the predominant explanation for females and older workers, as does schooling for those aged 14-19.

95937—7½

4. Average Hours Worked

Aggregate demand has both a short-term and a long-term effect on hours worked. In the short run, firms will vary overtime hours to meet changes in the labour requirements. In periods of slack demand, shorter work weeks may be adopted temporarily to avoid laying off experienced workers. A more prolonged period of weak demand will create pressures on the part of workers and their representatives for the instituting of a shorter work week. In contrast to the cyclical fluctuations in overtime and in short shift work, such a reduction in hours worked is not reversed when demand recovers. In addition to aggregate demand, variables reflecting the personal income tax structure are included, in order to test whether the substitution effects of changes in tax rates are powerful enough to offset the income effects. As exemption levels have only an income effect, the coefficient for this variable is expected to be negative.

Equation 3-7

$$M_t = 45.3435 + \underset{(11.84)}{.1599\ D_t} - \underset{(1.79)}{.0699\ T_{-2}} - \underset{(1.77)}{.0033\ E_{-1}}$$

$$R_c^2 = .95$$

$$(F = 61.74)$$

$$DW = 1.86$$

$$Sest = .1836$$

Variables:

M_t - Average hours worked per week. 27/

While the response to tax changes in terms of an alteration in the number of hours is weak, the demand variable once again turns out to be particularly important. It also is found to operate without a lag, and is easily explained. A decision to leave the labour force is a discrete one, requiring careful consideration and thus substantial delays after the initial causal forces are felt; the reduction of hours is a marginal type of adjustment, and no great delay in reaction is to be expected.

E. SUMMARY

To conclude, we find that the tax variables have played a rather minor role in affecting labour supply. They do appear to have a modest effect upon net migration, and upon the participation rates of older workers and females.

On the other hand, the state of aggregate demand has proven to be of particularly great importance in affecting the growth of labour input. There is first of all a substantial impact of departures from full employment upon population movements, both into and out of the country. In addition, hours worked have also been found to be very dependent on this variable. Since the decline in hours is largely irreversible, departures from full employment prevent re-attainment of the equilibrium path and set a new and lower bound to the level of potential output.

Finally, the participation rates of different age-sex groups are associated with a variety of structural changes which accompany economic growth. The need for increasingly better educated workers has led to a sharp increase in the schooling of young people, thereby reducing their participation rates. Similarly, growth has led to a decreased demand for agricultural products and thus for factors specific to that industry. This shift in demand has been largely directed toward the service industries.

The interaction of the effect of these structural changes on the demand for the labour of different age-sex groups has been substantial, leading to a reduction in the utilization of older workers and rapid absorption of female workers.

The implications of these trends for growth will be discussed later. The implications for a variety of other social problems may be much more significant, but this lies beyond our present compass.

REFERENCES

1/ For example, Gary S. Becker, "An Economic Analysis of Fertility" in Demographic and Economic Change in Developed Countries, National Bureau of Economic Research, 1960.

2/ Some, but not all of this recent decline can be attributed to the changed structure of the child-bearing population.

3/ For example, in 1950 real product per head in the United Kingdom, Germany and Italy was respectively 79%, 51% and 33% of the Canadian level. By 1959 the relative positions of these countries had improved to 83%, 79% and 45% of the Canadian level. (Source: Paige "Economic Growth, the Last Hundred Years", National Institute Economic Review, No. 16, July 1961, Table 7, p. 37.)

4/ Furthermore, large changes in the demand for labour could lead to a relaxation of restrictions on certain types of immigration as well.

5/ See the tests of this hypothesis in Section D below.

6/ See Table III-2 above.

7/ H. D. Woods and Sylvia Ostry, Labour Policy and Labour Economics in Canada, Macmillan Co., 1963, pp. 296-297.

8/ See Section D.

9/ In 1921 males in this group accounted for 71% of the labour force; in 1901 they accounted for 64%. (Census of Canada, 1921, Vol. IV, p. 92, and Census of Canada, 1961, Vol. III.3, Table 15.)

10/ See Gary S. Becker, Human Capital, National Bureau of Economic Research, 1964, for a complete discussion of the measurement of these rates of return and for estimates of the private and social rates of return in the United States. For Canadian estimates see J. R. Podoluk, Earnings and Education, D.B.S., December 1965.

11/ The share of output accounted for by agriculture has declined from about 20% in the 1920's to 5% in the early 1960's. The share of the labour force in agriculture declined from 33% to 10% over this period. See the discussion in the next chapter.

12/ Canada Year Book, 1961, Tables 4 and 5, p. 732.

13/ C. D. Long, The Labour Force Under Changing Income and Employment, National Bureau of Economic Research, 1958, Chapters 6 and 7.

14/ Long points out that the stock of household appliances in the United States increased almost fourfold between 1920 and 1950, whereas the number of married women only increased by about 70%. Ibid., Table 18, p. 120, and Table A-6, p. 297.

15/ C. D. Long, op. cit., p. 23.

16/ The initial very low share of females in the agricultural labour force may be a statistical illusion because of the under-reporting of work done by farm wives.

17/ For a discussion of this process see Simon Kuznets, Economic Change, Essay 9, New York: Norton, 1953, pp. 253-277.

18/ M. Urquhart and K.A.H. Buckley, Historical Statistics of Canada, Cambridge, 1965, Series D406-411, p. 105.

19/ Maddison calculates the average number of weeks worked per year in Canada to be 50.7 in 1870 and 48.0 in 1960. (A. Maddison, Economic Growth in the West, Allen & Unwin, 1964, Table 1-4, p. 31.)

20/ Such pressures can lead to the institutionalization of a shorter work week in labour agreements and in legislation. This long-lasting effect of unemployment upon normal hours worked needs to be distinguished from the impact of unemployment upon average hours worked brought about by the elimination of overtime and other similar temporary reductions in average weekly hours.

21/ See the discussion in Appendix A, of this study.

22/ See the next section for a discussion of these tests.

23/ To be more specific, each individual in the population is assigned an exemption appropriate to his age, taking into account the difference between exemptions for adults and for children. Total potential exemptions of the population are then divided by population to obtain the variable used.

24/ The sources for the variables included in equations 3-1, 3-2 and 3-3 are as follows:

Immigrants (F) - D.B.S., Canada Year Book, 1966, Table 1, p. 224.

Emigrants - total (Pa) - D.B.S., Canada Year Book, 1959, Table 10, p. 188, and 1963-64, Table 12, p. 210.
- workers (W) - H. D. Woods and S. Ostry, Labour Policy and Labour Economics in Canada, Macmillan, 1962, Table XVI, p. 297.

Population of Canada (Pc) - D.B.S., National Accounts, Appendix Table I.

Labour Force, Canada (Lc) - D.B.S., National Accounts, Appendix Table II.

Demand (D) - Preliminary version of Table II-1.

Tax rate (T) - D.N.R., Taxation Statistics.

Exemption (E) - D.N.R., Taxation Statistics.

25/ The sources for the variables included in equations 3-4, 3-5 and 3-6 are as follows:

Participation rates, persons over 65 (R^o); 14-19 year olds (R^y); females (R^f) - D.B.S., Labour Force Survey, Special Table 1, Annual averages.

Share of Agriculture in the Labour Force (A); Share of Services in the Labour Force (S) - D.B.S., Canada Year Book, 1962, Table 4, p. 711, and Canada Year Book, 1963-64, Table 4, p. 715.

High School Attendance (H) - D.B.S., Canada Year Book, 1963-64, Table 1, p. 336. (For earlier years, D.B.S., Student Progress Through the Schools, by Grades, 1960, Table 1, pp. 23-25, up to 1953.

Population aged 14-19 - D.B.S., Canada Year Book, 1963-64, Table 30, p. 183, and related earlier volumes.

26/ This is the series used in the analysis of potential output described in Appendix A.

27/ Hours (Mt) - derived from the potential output study presented in Appendix A.

CHAPTER IV: TECHNICAL CHANGE

Since the pathbreaking studies of Solow and Kendrick, 1/ analysts of economic growth have become increasingly aware of the importance of technical change. As we define it, technical change encompasses all factors which shift the relationship between output and the two inputs of labour and capital as conventionally measured. This residual factor, therefore, is affected by factors in addition to technological change per se. These include the following:

(1) The Existence of Economies of Scale and Other Factors Reflecting a Mis-specification of the Production Function. While we find no grounds statistically for rejecting the assumption of constant return to scale, it is likely that increasing returns exist in various sectors of the Canadian economy—such as transportation, communications, utilities and some industries within manufacturing, and that increasing returns in these sectors may offset the effect of diminishing returns in primary industries.

If increasing returns to scale predominate, the estimates of the contribution of both labour and capital to economic growth are understated, and our projection of future growth rates under alternative assumptions will be conservative.

(2) Improvements in the Quality of Capital. New capital goods embody the latest technology. Earlier we discussed our statistical tests of this hypothesis, which are disappointing. We read these results to indicate that embodiment is not important at the margin, so that functions

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which treat technology as disembodied may be safely used for many analytical purposes.

(3) Changes in the Composition of Output. We have already examined the role of changes in the distribution of resources between the four broad sectors. In this chapter we shall examine changes in the distribution of resources in more detail.

(4) Improvements in the Quality of Labour. In the United States, Denison 2/ found that the improved quality of labour brought about by higher levels of education has been an important source of economic growth. In this chapter we examine the effect of changed educational levels and changes in the age-sex composition of the work force which have affected the quality of the average employee.

(5) The Omission of Other Inputs. These include land, natural resources, and the quantity and quality of management.

The effect of each of these factors is distinguished from pure technological change. The case of economies of scale and inter-sectoral shifts simply reflect mis-specification of the production function and aggregation errors.

When improvements over time in the quality of a factor of production are important, each factor should be measured as a weighted sum of its components, each component being given an appropriate quality weight. 3/ Unlike pure technical change, changes in the quality of inputs do not bring about a permanent and irreversible shift in the relations between output and input. To maintain a gain in measured productivity achieved via an increase in the quality of the labour force would require a continuing investment in education and training. Otherwise the quality of the labour force would gradually decline to its previous level and the gain in productivity would be reversed. After a technological

discovery, on the other hand, the relations between outputs and inputs is permanently shifted. A continuing investment in the discovery of new technologies is not required to maintain the resulting gain in productivity. 4/

A. THE QUALITY OF THE LABOUR FORCE: AGE-SEX COMPOSITION

One of the important variables that may explain observed shifts in the relationship between output and input as conventionally measured is the change in the quality of the labour force. Two basic sources of quality change can be distinguished: the changing age-sex composition of the labour force, and the increase in the average ability of workers as a result of education and training.

The first source can be measured by comparing labour input standardized for differentials in age and sex with labour input as conventionally measured. The changing age-sex structure in Canada is illustrated in Table IV-1. We note that there has been a reduction in the relative importance of old and young men, which would serve to raise the average quality of the labour force, and an increase in the proportion of women, which has tended to lower the average quality of the labour force. 5/ To evaluate the effect of these shifts in quantitative terms, we have weighted each group by its relative earnings, assuming that earnings differentials reflect the relative productivity of the various age and sex groups. These earnings differentials are summarized in Table IV-2.

Applying the early year weights, a net reduction in the average quality of the labour force between 1921 and 1961 of 1.26% is obtained. If the 1961 weights are used, the estimated reduction is 2.76%. Thus, for the period as

a whole we observe a very slight decline in the average quality of the labour force as the net result of the various changes in its age and sex composition.

TABLE IV-1

PERCENTAGE DISTRIBUTION OF THE LABOUR FORCE, CANADA

Age	1921		1961	
	Male	Female	Male	Female
Less than 20	9.6	3.7	4.6	4.2
20-24	10.2	4.0	8.8	5.3
25-64	60.9	7.4	55.1	19.3
Over 65	3.9	0.4	2.0	0.7

Source: 1921 Census, Vol. IV, p. 92.
1961 Census, Vol. III.3, Table 15.

TABLE IV-2

RELATIVE EARNINGS OF WAGE EARNERS BY AGE AND SEX, 1931 AND 1961, CANADA

Age	1931		1961	
	Male	Female	Male	Female
Less than 20	.31	.30	.28	.28
20-24	.57	.49	.62	.49
25-64	1.00	.65	1.00	.53
Over 65	.79	.35	.70	.39

Source: 1931 Census, Vol. V, Table 8, p. 16.
1961 Census, Vol. III.3, Table 15.

One important source of labour force growth has been immigration. The population of immigrants has a higher proportion of males aged 19-60 than that of native born Canadians, as is illustrated in Table IV-3.

Assuming that the participation rates of immigrants are similar, for comparable ages and sexes, to those of the native born, estimates of the labour force composition of immigrants may be obtained. These are also presented in Table IV-3.

TABLE IV-3

IMMIGRANT AND DOMESTIC POPULATION AND LABOUR FORCE DISTRIBUTIONS, 1950-60

(a) Population

	Domestic Population		Immigrants	
Age	Male	Female	Male	Female
Under 19	20%	20%	13%	12%
19-60	25	24	39	32
Over 60	5	6	2	3
Total	50%	50%	53%	47%

(b) Labour Force per 100 Population

Under 19	9.6	6.8	6.2	4.1
19-60	23.8	8.2	37.0	10.9
Over 60	2.5	0.6	1.0	0.2

Source: Canada Year Books, 1951-61, "Immigration Statistics".

It is not obvious, however, that this assumption about the participation rates of immigrants is valid. A check on this assumption is provided by the work intentions of immigrants. These reveal that anticipated male participation rates are 75%, and female are 28%. 6/ These may be compared with the rates implicit in Table IV-3 of a participation rate of males of 82%, and one for females of 33%. The slight differences are reasonable, for no doubt some persons will join the labour force upon arrival despite their expressed lack of intention to do so.

If we standardize the immigrant labour force thus derived for age-sex composition using the earnings weights for 1931 in Table IV-2, we find that the average quality of immigrants is 15% greater than that of the average member of the Canadian labour force. This is clearly due to the very great concentration of young males of working age among immigrants. 7/

Because their quality—in terms of the age-sex composition—has been superior to that of the domestic labour force, any increase in immigration relative to the growth of the labour force from domestic resources will improve the average quality of the over-all labour force, and a decrease in immigration will have the opposite effect.

Offsetting this in part has been the emigration of Canadians. While there are no reliable flow data that we have been able to use, information about Canadians resident in the United States 8/ suggests that their quality is somewhat above that of the domestic labour force. 9/ Unfortunately, it is impossible to obtain precise estimates of the net effects of migration in terms of the age-sex composition of the labour force. It is clear, however, that in the past net migration to Canada has had beneficial effects on this aspect of the quality of the Canadian labour force.

B. THE QUALITY OF THE LABOUR FORCE: EDUCATION

Improvements in the quality of the labour force brought about by increasing the skill level of workers through education and training have been found to be particularly important in the United States. Two empirical approaches have been used. The first approach is to regard the improvement of these skills as the acquisition of human capital, and then to estimate the rate of return on this form of investment. 10/ The second approach is

to measure the growth effects of these activities more directly. 11/ We shall adopt the latter approach to analyze the contribution of education to economic growth in Canada.

The effect of education on productivity cannot be derived directly from income data, since not all the income of the more highly educated is attributable to education. A portion of it is in fact a form of economic rent derived from native intelligence, personal motivation, return on inherited property, and other such sources of personal advantage.

That this component of income exists is recognized by most students of the role of education in growth, but definitive estimates of its magnitude are not available. Denison's approach is to make a best guess; he assumes that education accounts for three-fifths of the reported income differentials. Although this is hardly a sophisticated measure, it is clear that some kind of adjustment is necessary. Lacking anything better, we shall make the same assumption.

Denison also argues that the appropriate measure should account not only for the increase in the number of years of schooling, but also for the increase in the average number of days spent in school per year. This is to assume that increasing the school year by a given proportion has the same impact on labour's effectiveness as increasing the number of years of schooling by the same proportion. We agree with Abramovitz 12/ that it is difficult to believe that a person with a grade eight education in 1963 is as well educated as a college graduate in 1910. Nor does there appear to be any indication that the number of days of schooling has any direct effect on labour's productivity as measured by earnings. We therefore conclude that the adjustment for days in the school year overstates by a substantial

amount the contribution of education to economic growth, and it is therefore omitted from the subsequent analysis.

The calculations below were carried out by one of the authors in a previous study. 13/ The estimates indicate that as a result of formal education the quality of labour increased by just under 7% for the period 1926-56. This is about one half of the importance of education to growth in the United States, calculated on our basis. The disparity is largely explained by the significant lag in Canada in educating large numbers of its population, as can be seen in Table IV-4.

TABLE IV-4

PERCENTAGE OF THE POPULATION UNDER 25 IN SCHOOL, CANADA AND THE UNITED STATES

	1891	1901	1911	1921	1931	1941	1951	1956
Canada	36.5	37.6	43.3	41.5	36.2	39.6	45.7	51.1
United States	41.7	42.1	51.0	46.1	41.3	51.0	49.6	53.0

Source: Censuses of the two countries.

As Canada has only recently closed this gap, the impact will be felt in future decades, whereas the growth effects in the United States occurred mainly in the postwar period.

These calculations indicate that increased formal schooling contributed about .17 percentage points to the growth rate of potential output over the period 1926-56. This is one half the adjusted contribution in the United States of .35 percentage points. Because Canada's growth rate was about one-third greater than that of the United States, the contribution of education accounts for only 5% of the growth rate here as compared to 12% in the latter country. 14/

The Economic Council of Canada, in its Second Annual Review, finds that "the average real income per person in the labour force is estimated to have been roughly one-quarter higher in 1961 than it would have been if the average educational attainment had remained at the 1911 level". 15/

Our own figure is significantly less—about 7%—but this may be explained by the shorter period selected (1926-63) and the use of the "days" adjustment in the Economic Council study. If we lengthen our period to 1911-61 to coincide with theirs, the increase due to education that we obtain is 12%. Revision of Denison's work to eliminate the "days" effect reduces the role of education in the United States by about 60%. A similar adjustment to the Economic Council's work would appear to reconcile the remaining discrepancy.

The critical question, therefore, is whether the "days" adjustment is appropriate. It appears to us that one of the major sources of the increase in days, the shift from rural to urban schools, reflects the general migration from agriculture. To the extent that our evaluation of the contribution of inter-industry shifts of resources has allowed for the effects of this migration, adding in the adjustment for increased days of schooling per school year would double count this contribution. The data are too weak to enable a single, definitive statement as to the quantitative importance of education. What is suggested, in either case, is that formal education has not played a major role in expanding the potential of the Canadian economy in the past.

Other forms of investment in human capital, such as on-the-job training, health improvements, productive wage increases, and improvements in channeling new information 16/ are either not yet sufficiently developed conceptually or else require data which are not available for Canada at present.

One source of improvement of labour skills which has very great potential importance for Canadian growth has been the migration of workers into and out of this country. 17/ Table IV-5 reveals the rapid increase in the relative importance of professional workers in the immigrant labour force and the fact that this proportion was substantially greater than that of the domestic labour force in the period after 1951.

TABLE IV-5

RATIO OF PERCENTAGE OF PROFESSIONALS IN IMMIGRANT LABOUR FORCE TO PERCENTAGE OF PROFESSIONALS IN THE LABOUR FORCE, CANADA

Period	Male	Female
1947-49	0.77	0.50
1951-54	1.27	0.87
1956-60	1.55	1.02

Source: Economics and Research Branch, Department of Labour, The Migration of Professional Workers into and out of Canada, 1946-1960. Professional Manpower Bulletin No. 11, Queen's Printer, Ottawa, October 1961, Table 7, p. 21.

Offsetting this in part is the substantial outflow of Canadians, almost entirely to the United States. Table IV-6 below compares the occupational structure of emigrant workers to that of the domestic labour force.

If these occupational distributions were weighted by an index of average earnings, the quality of emigrant workers in terms of these skills is estimated to be about 10% greater than that of the domestic labour force. While this is an admittedly crude procedure, since emigrants may have higher or lower than average earnings in their respective occupational classes, it

would appear that emigration tends to lower the average skill content of the domestic labour force. 18/

TABLE IV-6

RELATIONSHIP OF OCCUPATIONS OF CANADIAN-BORN WORKERS EMIGRATING TO THE UNITED STATES TO THOSE OF THE DOMESTIC LABOUR FORCE

Occupation	Share in Canadian Labour Force, 1951	Share in Emigrants to U.S., 1950-55
Professionals, technical, etc.	7.5%	24.3%
Clerical	17.5	28.8
Managers	8.5	5.9
Foremen	15.9	13.4
Operatives and Labourers	27.0	16.3
Farmers and Farm Labourers	15.6	2.7
Service Workers	6.4	4.9
Private Household Workers	1.5	3.7

Source: Department of Labour, Professional Manpower Bulletin No. 11, op. cit., Table 12, p. 32.

Our findings suggest that changes in the over-all age-sex composition of the labour force have not contributed to growth in the past in Canada. However, migration, both in and out, does appear to have had an effect on quality, as both emigrants and immigrants are not only more skilled than domestic workers, but they also have an age-sex structure more favourable for economic growth. Since these population flows are in part affected by the level of unemployment, the cost of high unemployment must include the loss of these skills as well as the loss of emigrant and potential immigrant workers.

Increases in the average educational level of workers, which have had a minor effect on growth in this country in the past, should become a much more important factor in the coming decades.

C. STRUCTURAL CHANGE AND ECONOMIC GROWTH

In Chapter II we presented an analysis of the importance of movements of resources between the four broad sectors—government, agriculture, residential and the PNF sector of the economy. The results indicated that from 7% to 10% of the observed change in aggregate output per employee over the 1926-63 period could be accounted for by the changed industrial composition of labour and capital, which reflects in part changes in the industrial composition of output.

In this section we inquire further into the effect of changes in the distribution of resources between sectors. First, we examine the importance of changes in the inter-industry distribution within the economy as a whole and within manufacturing. Second, we measure the extent to which inter-regional movement of resources has contributed to economic growth. Finally, we consider the interaction between the inter-industry and inter-regional changes.

Since the relatively large contribution of inter-sectoral movements has been found to explain the higher growth of total factor productivity in Canada relative to the United States, we shall compare the estimated effects for Canada to comparable estimates for the United States, where this is possible.

Detailed evidence on the importance of these shifts over the 1937-61 period may be derived from N. H. Lithwick's study of economic growth in Canada. 19/ According to this study, 15% of the growth of total private domestic product could be attributed to relative factor movements between private sectors.

These shifts between major sectors are unlikely to continue to provide such a powerful stimulus to growth in the future. This is because of the

central role of agriculture in the process, the movement from which has served to raise the over-all level of productivity in the economy because of the relatively low level of output per man in that sector throughout the period under study. Further reductions in the agricultural labour force cannot be as substantial simply because that group has been reduced to such a relatively small proportion of the total labour force, as can be seen in Table IV-8.

These inter-sectoral movements also help to explain the higher growth rate of productivity in Canada than in the United States. 20/ When the effect of inter-sectoral shifts in both countries is eliminated, the remaining residual growth rates are closer together, as can be seen in Table IV-7. This is due to the relatively greater decline in Canadian agriculture during this period, which is the major source of the inter-sectoral productivity gains. For the United States, the bulk of the decline in agriculture had occurred earlier and had extended over a longer period than that in Canada, reducing its effect during the period under study, as can be seen in Table IV-8.

TABLE IV-7

ROLE OF INTER-SECTORAL SHIFTS, UNITED STATES AND CANADA, PRIVATE DOMESTIC ECONOMY

	U.S., 1929-57 5 Sectors	Canada, 1937-61 10 sectors
Average Annual Growth Rate of Output	2.90%	4.31%
Measured Factor Contribution	.94	1.47
Inter-Sectoral Shifts	.11	.66
Residual Growth Rate	1.85	2.18

Source: Lithwick, op. cit., Table 37, p. 91.

TABLE IV-8

PROPORTION OF CIVILIAN LABOUR FORCE IN AGRICULTURE, UNITED STATES AND CANADA, SELECTED YEARS

	Canada	United States
1926	34.2	n/a
1929	33.0	21.2
1939	29.7	17.4
1949	21.3	12.9
1956	13.4	9.7
1963	9.5	6.8

Source: U. S.: Economic Report of the President, 1965, Table 321, p. 214. Canada: Canadian Statistical Review, 1959 Supplement, Table 8, p. 35, and 1963 and 1964 monthly reports.

Whereas the relative share of agriculture in the labour force fell by 14 percentage points in the United States over the period, in Canada the decline was almost twice as great. In addition, the decline in the United States was relatively steady over the entire period, whereas for Canada about two-thirds of the decline occurred in war and immediate postwar years.

It is possible to examine industrial shifts at a more detailed level of aggregation within the manufacturing sector. For the United States, shifts among 16 industries accounted for 8.5% of the residual growth rate in that sector. This would provide a .05 percentage point rise in the aggregate contribution of factor shifts and reduce the aggregate residual in the private domestic economy of the United States to 1.80% per year.

For Canada, it has been found that similar shifts between manufacturing industries accounted for about 5.5% of productivity growth in that sector. 21/ This would raise the aggregate factor shift contribution by about .07 percentage points and reduce the aggregate residual in the private domestic economy of Canada to 2.11% per annum.

It is likely that further intra-sectoral shifts will not be a major source of productivity advance, both because of the relatively small weight of other sectors, and because of the small contribution of shifts within manufacturing.

In summary, we have found that inter-sectoral shifts of factors have been a major source of growth in Canada, accounting for about 15% of the growth rate in private domestic output between 1937 and 1961. This also serves to explain much of the observed discrepancy in the aggregative residual growth rates of Canada and the United States, suggesting that technical change has increased at about the same pace in the two countries. This can be substantiated by comparing the residual growth rates at the major sector level in the two countries, albeit over somewhat different time spans.

TABLE IV-9

RESIDUAL GROWTH RATES, SELECTED INDUSTRIES,
CANADA AND THE UNITED STATES

	Canada, 1937-61	U.S., 1929-57
1. Agriculture	1.60%	1.68%
2. Mining	1.92	2.05
3. Manufacturing	2.27	1.96
4. Transportation, communication, etc.	3.33	4.03

Source: Lithwick, op. cit., Table 19, p. 52, and Table 34, p. 83.

The observed similarity at the major sector level suggests that there are technological parallels in the two countries, 22/ and lends support to the conclusion that inter-sectoral shifts partly reconcile the observed differences in total factor productivity between the two countries at the aggregate level.

Inter-Regional Shifts

Shifts between sectors are not the only source of productivity gains resulting from structural changes. If persons move from regions where their productivity is low, such as the Maritimes, to ones where it is higher, such as Ontario, then there will likely be a net gain in productivity for the economy as a whole.

Over the 1931-61 period this has been a very minor source of productivity growth in Canada, for it raised the growth rate of aggregate output per man by .02 percentage points per year between 1931 and 1951. 23/ This contrasts to the inter-sectoral effect during the same period which raised the rate by .45 percentage points. 24/

These effects are not necessarily independent, however, for it may be that those changing residence may also be changing sectors. To examine this possibility the effects of inter-sectoral shifts within regions are calculated. As these accounted for about 90% of the aggregate inter-sectoral effect, the degree of interaction between the two effects has not been substantial.

As is illustrated in Table IV-11, the inter-sectoral variation in earnings within regions between agriculture and other sectors is much greater than the inter-regional variation in earnings within agriculture and other sectors.

TABLE IV-10

REGIONAL AND SECTORAL CHANGES IN THE LABOUR FORCE, CANADA, 1931-51

	1931				1951			
Region	Agr.	Non-Agr.	Total	Ratio Agr./Total	Agr.	Non-Agr.	Total	Ratio Agr./Total
1. Atlantic Provinces	3.4	7.6	11.0	31%	1.2	7.0	8.2	15%
2. Quebec	5.5	19.2	24.7	22	3.8	24.6	28.4	13
3. Ontario	8.0	27.3	35.3	23	3.9	32.5	36.4	11
4. Prairies	10.9	11.0	22.1	50	6.5	11.9	18.4	35
5. British Columbia	1.0	5.9	6.9	14	0.6	8.0	8.6	7
	28.8	71.1	100.0		16.0	84.0	100.0	

TABLE IV-11

MEAN EARNINGS (MALE WAGE EARNERS) BY REGION AND BY SECTOR, CANADA, 1961

Region	Agr.	Non-Agr.	Total
1. Atlantic Provinces	$1,195	$2,923	$2,882
2. Quebec	1,365	3,502	3,649
3. Ontario	1,440	4,045	3,984
4. Prairies	1,235	3,725	3,578
5. British Columbia	1,770	4,049	4,005
CANADA	1,362	3,741	3,679

Source: Census of Canada, 1961, Vol. 3.3-10.

In contrast to the usual stress on the importance of inter-regional mobility, these findings indicate the inter-regional movements of the past contributed little to measured productivity advance. Moreover, even if all the interaction between inter-regional and inter-sectoral shifts is ascribed to the regional movements, the contribution to the growth rate of total factor productivity of inter-regional movements would still be less than 3%, and their share in the contribution of both types of structural change combined would be less than one-sixth.

D. PURE TECHNICAL CHANGE

As we indicated earlier, part of the residual factor in economic growth may be explained by what are essentially measurement errors—errors of aggregation and measures of the inputs which do not take into account quality change. However, after account is taken of the effect of the changed inter-sectoral composition of output and resources and of improvements in the quality of the labour force brought about by education (offset in part by changes in the age-sex distribution of the labour force), a substantial residual remains.

No doubt the residual could be reduced further by a more detailed and more complete specification of the inputs. However, it is unlikely that such a procedure could eliminate the residual entirely. Moreover, we would be suspicious of such a result, in view of the efforts made to improve technology and of various studies which have pointed up the importance of innovations in particular industries. Unlike the addition of higher quality factors of production, the making of an innovation involves a permanent shift in the relationship between output levels and input levels. 25/

In this section we briefly discuss the influence of education and of research and development upon the pace of technical advance. We make no attempt to measure the contribution of these activities to the growth rate, since we believe that fruitful analysis of the effects of these activities would require a detailed analysis at the industry or firm level.

There is a greater likelihood that investment in both activities is below rather than above socially optimal levels. Innovation resulting from research and development activities have significant external effects—benefits which cannot be captured by the individual firm. One cannot assume, therefore, that the activity levels set by private firms are optimal in a social sense. Furthermore, the smaller firms in the economy may not have access to financial resources sufficient to mount a research and development operation at all.

As for education, the bulk of the activity lies within the public sphere, and the bulk of the remainder is accounted for by private non-profit institutions. There is no assurance that the level of education is optimal in a social sense, and evidence on the high rate of return on human capital suggests that there has been considerable underinvestment in this security in the past. 26/

As these arguments apply to the United States as well as to Canada and as the economies of the two countries are similar, it is instructive to compare them. The extent to which Canada lags behind the United States in these activities would provide some indication of how much room there is for improvement. Let us now turn to an examination of both factors.

Some effect of improved education can be reasonably regarded as an increase in human capital. This approach provided the basis for the analysis

of the previous section. Like investment in plant and equipment, increases in this stock of human capital contribute to growth; the mere maintenance of the stock does not. If this were the only contribution of education to growth, we would expect a society with a high, but constant, level of education to grow at the same rate as another society with a low, but constant, level of education.

We reject this view, since it ignores the impact of education upon the discovery of new knowledge. Corresponding to the growth of R&D is the growth of the use of highly educated technical and professional personnel. Much of the process of discovery of new knowledge is dependent upon the highly educated and trained scientist, whether he is working in business, in government, or in the universities. Measures which ignore this role of the level of education in economic growth will likely understate the importance of education. As higher education is likely to contribute more to the process of technological advance under modern conditions, we shall devote our attention to it.

Table IV-12 presents a comparison of the percentage of the labour force with some higher education and with university degrees in Canada with the corresponding estimates in the United States for selected years. As is readily apparent, the proportion of persons with university degrees in Canada is not only below that of the United States; the differential has widened over the period. A comparison of persons with some higher education presents a similar picture.

Given the estimated high rate of return on investment in higher education in the United States, and given the recent evidence assembled for Canada, there appears to be a great deal of room for expansion of investment in higher education in Canada.

TABLE IV-12

MINIMUM YEARS OF EDUCATIONAL ATTAINMENT OF MALE LABOUR FORCE, AGED 25-34 AND 55-64, CANADA 1961, UNITED STATES 1960

Minimum Educational Attainment	Age Group	Per Cent of Male Labour Force		Per Cent by Which U.S. Exceeds Canada
		Canada	United States	
8 Years Elementary School	25-34	81.5	88.9	9
	55-64	55.5	68.8	24
4 Years' High School	25-34	28.2	57.2	103
	55-64	16.9	26.1	54
University Degree	25-34	6.0	14.7	145
	55-64	4.2	7.0	67

Source: "The Contribution of Education to Economic Growth", by Gordon W. Bertram, Staff Study No. 12, Economic Council of Canada, June 1966, Table 12, p. 22.

Research and Development

Let us now turn to a brief review of R and D expenditures in Canada. We observe in Table IV-13 that there has been no discernible trends in these expenditures as a proportion of sales. In fact, the only industries apparently expanding this activity are chemicals and electrical products. On the other hand, there has been a substantial decline in these expenditures in transportation equipment, textiles and rubber manufacturers. In fact, total reported industrial R and D varied quite widely, from $66 million in 1955 to $149 million in 1957, $100 million in 1959 and $115 million in 1961. This is in sharp contrast to the United States, where these expenditures rose steadily from $7,725 million in 1957 to $9,609 million in 1959 and $10,872 million in 1961.

These data also suggest that in the United States R and D is being carried out at a much greater level of intensity than in Canada. On a per capita basis, these expenditures are ten times those in Canada, while within manufacturing divisions the ratios of R and D to sales are consistently higher, varying from near equality in textiles to a factor of ten higher in wood and furniture. Part of this is due to the very large role played by the government in the United States, which in 1961 financed 60% of total industrial R and D, whereas in Canada this proportion was about 15%. As can be seen in Table IV-14, more than one half of these federal expenditures in the United States are in missiles and aircraft, and one quarter are in electrical industries, whereas the share of these industries in the R and D expenditures by the Government of Canada are one third (transportation equipment) and one half (electrical products). Excluding rubber, the discrepancies in the remaining industries are not nearly as great, although the levels of private R and D as a proportion of sales is still consistently lower in Canada.

TABLE IV-13

CANADIAN TOTAL RESEARCH AND DEVELOPMENT EXPENDITURES AS PER CENT OF SALES OF REPORTING FIRMS

Industry	1955	1957	1959	1961
Mines, Quarries, Oil	.59	.99	.99	.91
Foods & Beverages	.12	.13	.12	.16
Rubber	1.32	1.64	.53	1.08
Textiles	.47	.60	1.22	1.01
Wood	.21	.18	.23	.07
Furniture				.67
Paper & Allied	.27	.39	.44	.45
Primary Metal	.42	.40	.40	.44
Metal Fab	.56	.67	.71	.69
Machinery				1.10
Transport Equipment	2.10	5.04	1.90	1.47
Electrical Products	1.44	1.66	1.81	2.67
Non-Metallic	.89	.77	.78	.75
Petroleum & Coal	.45	.54	.30	.35
Chemicals	1.13	1.34	1.54	1.49
Other Manufacturing	.38	.55	.65	.98
Transportation	.24	.20	.14	.14
Other Non-Manufacturing				
Totals	.63	1.10	.73	.74

TABLE IV-14

RESEARCH AND DEVELOPMENT EXPENDITURE AS PERCENTAGE OF SALES OF FIRMS REPORTING R and D, UNITED STATES AND CANADA, 1961

Industry	United States			Canada		
	Federal R&D	Private R&D	Total R&D	Federal R&D	Private R&D	Total R&D
Mines, Oil, Quarries					.91	.91
Food & Beverages	.3		.3		.16	.16
Textiles & Apparel	*	*	.6		1.01	1.01
Lumber, Wood,)					.07	.07
Furniture)	*	*	.5		.67	.67
Paper & Allied	*	*	.7	**	.45	.45
Chemicals:	1.0	3.6	4.6	**	1.49	1.49
Industrial	1.1	4.4	5.5			
Drugs	.1	4.6	4.7			
Other	1.2	1.6	2.8			
Petroleum Refining a/	.1	.9	1.0		.35	.35
Rubber	.6	1.6	2.2		1.08	1.08
Stone, Clay and Glass (Non-Metallic)	.2	1.6	1.8		.75	.75
Primary Metals	.1	.7	.8	**	.44	.44
Ferrous		.7	.7			
Non-Ferrous	.2	.8	1.0			
Fab. Met. Products	.4	.9	1.3	.01	.68	.69
Machinery	1.4	3.0	4.4		1.10	1.10
Electrical	6.6	3.7	10.4	.78	1.89	2.67
Communication	8.2	4.2	12.4			
Other	5.5	3.5	9.0			
Motor Vehicles (Trans. Equipment)	.7	2.2	2.9	1.03	.44	1.47
Aircraft	21.6	2.6	24.2			
Instruments b/	3.3	4.0	7.3			
Scientific	5.3	3.9	9.2			
Optical	2.1	4.0	6.1			
Other Manufacturing)				.06	.92	.98
Non-Manufacturing)	.9	.5	1.4			
Total	2.6	1.8	4.4	.14	.60	.74

* Not seperately available, but included in the total.

** Less than .005%.

a/ Oil refining and extraction. Includes coal in Canada.

b/ For Canada, included under other manufacturing.

It is clear that research and development in Canada—even after allowing for differences in industrial composition of output and for the great role of federally financed and defence oriented research in the United States—is at a level relative to sales much lower than that performed in the United States.

What accounts for this? Several of the following factors may be important:

1. The ready access by wholly owned subsidiaries to technical changes developed by parent firms abroad.

2. The greater relative importance of smaller sized firms in Canada. It is well known that in the United States R and D spending is concentrated among larger firms.

3. The lower level of spending by governments and by universities on basic research in Canada. Since applied research and basic research are to some extent complementary activities, the lower level of basic research carried out in Canada may reduce incentives for private firms to carry out industrial research.

4. The lower availability in Canada of skilled scientists and technicians—perhaps partly because of reason 3 above.

5. The fact that management is less professionalized and has a lower educational level in Canada. 27/

As was pointed out above, since research and development are activities which have significant external effects, one cannot assume that the activity levels set by private firms are optimal in a social sense. Indeed, the

presumption is that, unless the programme is subsidized by the government, the research efforts mounted by individual firms will be inadequate.

The low level of R and D in Canada relative to the United States suggests there is a great deal of room for improvement. Of the reasons mentioned above, only the first provides any support for the argument that optimal R and D levels are lower in Canada. Even in this case, there is some danger that reliance upon borrowed technology alone by subsidiary firms may not be a socially optimal policy. The bulk of R and D is focused on new product rather than new process development and there is no guarantee that products developed by parent company research would be the products most suitable for the markets of the subsidiary firm.

The acquisition of new technology from foreign parents by Canadian subsidiaries is clearly of benefit to Canada, and it would be unwise to impede this flow of information. However, this does not mean that positive steps to encourage R and D expenditures within Canada are inappropriate. The close interaction of applied research and development—which accounts for the bulk of R and D expenditure by private firms—with product design indicates there may be scope for independent R and D establishments within subsidiary firms.

Furthermore, to the extent that these low relative R and D expenditure levels in Canada reflect the greater relative importance of smaller firms, there is a clearer case for public policies designed to encourage industrial R and D. The less frequent establishment of an R and D operation and the smaller scale of their R and D operations reflect, in part, the inadequate access to funds by smaller firms in imperfect capital markets.

Tax and subsidy programmes aimed at increasing the availability of funds for these activities can therefore be justified.

As for the other factors which may explain the relatively low level of industrial R and D expenditure in Canada, the lag in the expansion of public expenditures in the areas of higher education and basic research appears to us to be of major importance. These activities may also serve as indirect stimuli to research and development activities in industry.

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1/ R. M. Solow, "Technical Change and the Aggregate Production Function", Review of Economics and Statistics, August 1957, pp. 312-320. J. W. Kendrick, Productivity Trends in the United States, National Bureau of Economic Research, 1961.

2/ E. F. Denison, The Sources of Economic Growth in the United States, Committee for Economic Development, 1962, pp. 67-79.

3/ See, for example, Denison's estimates of the over-all contribution of the quantity and quality of labour input. Ibid., pp. 84-87.

4/ This is an oversimplification. New technological discoveries may require the use of higher quality inputs for their implementation—that is, there may be a significant interaction between technological change and the improved quality of the inputs.

5/ Relative earnings may be a weak indicator where discrimination distorts relative earnings.

6/ Canada Year Book, 1961, Table 9, p. 193.

7/ The occupational distribution of immigrants is discussed below.

8/ U.S. Census of Population, 1950, Special Report P-E, No. 3A, Table 41, pp. 88-89.

9/ Based upon participation rates and relative earnings in Canada, the average quality of emigrants is about 10% higher than the average quality of the resident labour force.

10/ See Gary Becker, Human Capital, National Bureau of Economic Research, 1964. See also Investment in Human Beings, a special supplement to the Journal of Political Economy, October 1962.

11/ E. F. Denison, op. cit., pp. 67-79.

12/ Moses Abramovitz, "Economic Growth in the United States", American Economic Review, September 1962, p. 672.

13/ N. H. Lithwick, op. cit., p. 22.

14/ Denison's estimate that changes in education account for 23% of productivity growth results from his using the number of days rather than the number of years of schooling as a measure of the level of education.

15/ Economic Council of Canada, Second Annual Review, p. 92.

16/ See Gary Becker, op. cit., for a discussion of each of these factors. See also the analysis of job training in the United States carried out by J. Mincer, "On the Job Training: Costs, Returns and Some Implications" in Investment in Human Beings, pp. 50-73.

17/ For a discussion of the benefits and cost resulting from the immigration and emigration of professional persons, see H. G. Grubel and A. D. Scott, "The Immigration of Scientists and Engineers to the United States, 1949-61", Journal of Political Economy, August 1966, pp. 368-378, and H. G. Johnson, "The Economics of the 'Brain Drain': The Canadian Case", Minerva, Spring 1965, pp. 299-311.

18/ This conclusion is consistent with the evidence on the emigration of Canadian scientists and engineers presented by Grubel and Scott, op. cit., Table 2, p. 372.

19/ N. H. Lithwick, op. cit., pp. 42-67.

20/ Ibid., Table 12A, p. 37, and Table 13, p. 39.

21/ George Post, T. K. Rymes and N. H. Lithwick, "Postwar Production Relationship in Canada", a paper presented to the National Bureau of Economic Research, Conference on Production Relations, October 1965, forthcoming, p. 60.

21/ These may be explained, of course, by the great mobility of labour, capital and ideas between the two countries, and by the fact that a significant proportion of Canadian industry is operated by subsidiaries of United States corporations.

23/ The regions included in the analysis are the Maritime Provinces, Quebec, Ontario, the Prairie Provinces, and British Columbia.

24/ The inter-industry effect referred to here reflects only the shift from agriculture to industry.

25/ In fact, increases in total factor productivity will likely understate the contribution of new product innovations, because the superiority of new products over old will not be adequately taken into account. See Richard R. Nelson, Merton J. Peck, and Edward D. Kalacheck, Technology, Economic Growth and Public Policy, The Brookings Institution, 1967, pp. 19-21.

26/ Becker estimates that the social rate of return to investment in higher education is at least 12.5%, and could well be much higher if some of the increase in knowledge is attributable to education (Becker, op. cit., pp. 118-119). The evidence available for Canada suggests that the rate of return on higher education in Canada is much higher. See J. R. Podoluk, Earnings and Education, D.B.S., 1965. See also G. W. Bertram, The Contribution of Education to Economic Growth, Economic Council of Canada, Staff Study, No. 12, 1966.

27/ This was noted by the Economic Council of Canada in their Second Annual Review, p. 62.

CHAPTER V: CAPITAL FORMATION

In this chapter we turn to an examination of the third source of economic growth—the rate of capital formation. Capital formation has not been as important a source of growth as either labour force growth or technical change. 1/ However, as it is probably more susceptible to influence by fiscal, monetary and tax structure policies, an analysis of this source of economic growth is particularly important.

The rate of capital formation is determined by the interaction between the propensity to invest on the one hand, and the availability of funds, from both domestic and foreign sources, on the other. Which of the blades of this pair of scissors is the more important determinant of the rate of capital formation in a particular period will depend upon the level of aggregate demand in relation to potential output and upon the willingness of policy makers to tolerate price level increases or a worsened balance of trade position.

It is our view that in the Canadian economy in the absence of induced offsetting policy moves, it is the propensity to invest that is of overriding importance. When the economy is operating below its full employment potential, a rise in the propensity to invest will bring about a rise in income and the savings and capital inflows necessary to finance the investment. Changes in the domestic propensity to save, on the other hand, will be largely nullified by offsetting changes in income which will keep savings in line with investment. Under such circumstances, the propensity to invest is the active determinant of the level of capital formation; the propensity to save and the capital inflow are accommodated to the propensity to invest

via changes in income levels and moderate changes in domestic interest rates. 2/

In an open economy under fixed exchange rates, this active role of the propensity to invest is particularly important, as the availability of funds from abroad limits the extent to which domestic interest rates respond to changes in investment and income. In such an economy, moreover, the availability of foreign funds means that the rate of capital formation is largely determined—in the absence of policy countermoves—by the propensity to invest even under conditions of full employment. Under these conditions, changes in investment demand will draw in funds from abroad to finance the expansion of investment. In such a situation, however, fiscal and monetary policies are unlikely to remain passive. The desire to avoid the inflationary consequences of an expansion in investment, and to prevent an increase in the deficit in the current account of the balance of payments will lead policy makers to adjust fiscal, monetary and other policies to dampen the investment boom. 3/

It is the existence of these other goals of public policy—avoidance of inflation and avoidance of large balance of trade deficits—which lend importance to the domestic propensity to save. Given these goals, an increase in the domestic savings rate is a necessary condition for the realization of a rise in investment under full-employment conditions.

Furthermore, as was argued above, it is the potential rate of growth of national product, not domestic product, which measures the growth of the potential material well-being of Canadian residents. An increase in capital formation which is financed via a rise in national savings will have a larger effect on the growth of national product than will a similar increase financed by the use of foreign funds. 4/ It follows that a policy designed to

increase the rate of economic growth by increasing the rate of capital formation must be concerned with savings decisions as well as investment decisions.

We therefore proceed as follows. First, we examine the determinants of the level of business fixed investment, including an assessment of the possible role of tax structure changes in affecting the propensity to invest. Second, we discuss the determinants of private domestic savings, looking first at corporate retentions and then at personal savings. Finally, we discuss the various policy combinations that could be used to bring about a balanced expansion of savings and investment at full employment.

A. THE PROPENSITY TO INVEST

Until recently the literature on investment has been dominated by the accelerator-residual funds controversy. There is general agreement that the relationship of current and expected output to capacity is a key determinant of the level of investment. There is a great deal of disagreement about the need to include profits or some measure of available funds as an additional determinant of investment. As for the rate of interest, meaningful results have been difficult to obtain with the typical models of investment behaviour fitted to empirical data. 5/ As will be discussed briefly below, however, recent empirical work based upon more carefully specified models has detected a significant effect of the rate of interest on investment. 6/

Profit was once assigned the role of a measure of the rate of return or expected profitability of new investment. It has become clear, however, that current and past profit levels may be poor measures of the expected rate of return. Indeed, the relationship of output to capacity may provide a better indication of the expected marginal rate of return.

However, those who reject the pure accelerator theory and its variants have argued that the availability of funds is an important determinant of investment. Since internal sources of funds are particularly important in some major sectors of the economy, this theory suggests that gross retained earnings be added as an explanatory variable.

This controversy is relevant for the influence of taxation of investment. If investment depends only upon expected output and capacity, then changes in the tax structure, and changes in the mix of monetary and fiscal policies, will not affect investment. Under these circumstances, the influence of taxation upon investment is confined to its aggregate demand effects—fiscal policy is important, the tax structure is not.

On the other hand, if investment depends partly upon the availability of internal funds, and if the corporate income tax is not fully shifted, changes in the burden of taxation upon corporations will affect the level of investment when aggregate demand is held constant by compensatory changes in other policies. If investment depends in part upon the cost of capital, then both changes in the mix of monetary and fiscal policies and changes in the tax structure could affect investment at a given level of aggregate demand.

In addition to the effects of capital requirements (as measured by the relationship between output and capacity) and of gross retained earnings, the role of monetary variables and of the marginal corporate tax rate itself will also be examined. The inclusion of monetary variables needs no explanation. The marginal tax rate is introduced in order to test whether the effect of tax rates upon the rate of return has had a significant influence on investment.

The general model which we examine may be stated more formally as follows:

Investment depends upon:

(a) Capital requirements, as measured by output in relation to capacity.

(b) The availability of internal funds, as measured by gross retained earnings.

(c) The costs of external funds (as measured by the rate of interest) or the general level of liquidity (as measured by the money supply).

(d) The expected rate of return on investment. In the absence of tax changes, we assume that the relationship of output to capacity is a reasonable proxy for the expected rate of return. The inclusion of the marginal tax rate will allow for tax-induced changes in the rate of return.

The various models were applied to aggregate annual data for the pre-war and postwar periods. We shall first discuss these finds, and then turn to discuss some supplementary evidence.

Two basic models are estimated with three alternative lag specifications for each. These are a capital stock adjustment model, which includes the lagged gross capital stock as an additional independent variable and a distributed lag investment model which includes the lagged value of investment itself as an additional independent variable. As the monetary and marginal tax rate variables are generally statistically insignificant, these variables are deleted from the equations reported in the table; however, the partial correlations of investment for each of these variables is reported. The other independent variables are introduced alternatively as simultaneous, lagged one year and averaged over the current and preceding year in the alternative lag formations.

The two basic models presented in Table V-1 are as follows:

Model I. Capital Stock Adjustment Model.

$$I_t = a + b\ \text{Ret} + c\ \text{Gap} + d\ K_t\text{-}1$$

Model II. Distributed Lag Model.

$$I_t = a + b\ Ret + c\ Gap + d\ I_{t-1}$$

where:

I = Business Fixed Investment (Excluding Residential Construction)

Ret = Gross Retained Earnings

Gap = Potential Output minus Actual Output (PNF Sector)

K = Capital Stock

(all of these variables are measured in millions of constant (1949) dollars).

Partial correlations are computed for the tax and monetary variables for each model.

The regression results obtained for the different variants of these models are tabulated in Table V-1. Of the sixteen equations presented in that table, the coefficient of the utilization variable has the correct sign in every one; incorrect signs for the coefficient of the retention variable occur only twice. The retention coefficient is statistically significant in twelve equations; the coefficient of the utilization variable in thirteen equations. 7/ The coefficients of both of these variables are statistically significant in nine equations.

However, the coefficients on both variables are quite unstable, both between different equations within each period and between periods for the same equation. This is due to the high intercorrelation between the utilization and retention variable (see Table V-2), a problem which has consistently plagued empirical testing of the accelerator-residual funds hypotheses.

According to the different coefficients on retentions in Table V-1, the impact of a dollar increase in gross retentions upon investment might be as

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TABLE V-1

INVESTMENT FUNCTIONS FITTED TO ANNUAL DATA FOR PREWAR AND POSTWAR PERIODS

Model I: $I_t = a + b\ Ret + c\ Gap + d\ K_{t-1}$

Period	Timing of Variables (exc.K)	a Constant	b Ret	Regression Coefficients (t values in parentheses) c Gap	d K_{t-1}	R^2	DW
1948-61	Current	-542.88	1.1993 (4.04)**	-.0081 (0.07)	—	.68	1.36
1948-61	Current	-3254.	.3605 (1.00)	-.7518 (2.87)**	.1709 (3.01)*	.82	1.79
1948-61	Lagged	-961.75	1.405 (4.93)**	-.1414 (1.11)	—	.73	NA
1948-61	Lagged	-2983.	.4643 (1.35)	-.7754 (3.73)**	.1487 (3.39)**	.86	2.03
1948-61	Averaged	-1600.	1.046 (6.21)**	-.1898 (1.80)*	—	.82	NA
1948-61	Averaged	-4162.	.5965 (2.70)*	-.9675 (6.54)**	.1805 (5.91)**	.96	1.63
Model II: K_{t-1} replaced by I_{t-1} (i.e., a Simple Distributed Lag Model)							
1948-61	Current	-906.	.7221 (3.10)**	-.1781 (2.06)*	.6797 (3.86)**	.86	1.83
1948-61	Lagged	-637.	.8035 (2.14)*	-.1507 (1.37)	.4879 (2.13)*	.80	1.54
Model I							
1927-39	Current	1218.	-.094 (1.03)	-.2376 (9.98)**	—	.91	0.81
1927-39	Current	-1960.	-.0967 (2.05)*	-.3607 (13.76)**	.1782 (5.32)**	.98	1.54
1927-39	Lagged	507.	.4433 (4.27)**	-.1280 (5.29)**	—	.93	NA
1927-39	Lagged	1071.	.4276 (3.94)**	-.1136 (3.60)**	-.0300 (0.74)	.92	2.12
1927-39	Averaged	342.	.2088 (2.39)*	-.1926 (9.51)**	—	.95	NA
1927-39	Averaged	-1022.	.2507 (3.97)**	-.2533 (10.88)**	.1011 (3.31)**	.97	1.89
Model II: K_{t-1} replaced by I_{t-1}							
1927-39	Current	542.	.1376 (1.79)	-.1381 (5.07)**	.4006 (4.30)**	.97	1.86
1927-39	Lagged	561.	.4384 (3.94)**	-.1381 (2.73)*	-.0462 (0.23)	.92	2.13

Note: Tests of regression coefficients are based on one-tailed t tests for the coefficient of Ret, Gap, and I_{t-1}, and a two tailed t test for the coefficient of K_{t-1}.

See variables following Table V-6.

high as $1.41 or as low as 42 cents for the postwar period. In the prewar period, the range is from 44 cents to -11 cents.

TABLE V-2

SIMPLE CORRELATIONS BETWEEN GROSS RETENTIONS AND THE GAP BETWEEN ACTUAL AND POTENTIAL OUTPUT

Prewar Period		Postwar Period	
Current	-.62	Current	-.72
Lagged	-.72	Lagged	-.76
Averaged	-.68	Averaged	-.80

Note: (See variables following Table V-6.)

However, not all of the estimates in Table V-1 are of equal validity. There is considerable evidence to indicate that investment responds with some lag to changes in its determinants, which suggests rejection of those models which use current values of the explanatory variables in favour of those with lagged values or averages of current and lagged values. Since the lagged capital stock is statistically significant in nearly all variants of Model I, we shall also reject those versions of Model I which exclude the lagged capital stock.

When ten equations are thrown out on these grounds, the range of the estimates is much narrower, as is illustrated in Table V-3.

TABLE V-3

RANGE OF COEFFICIENTS ON GROSS RETENTIONS*

	High	Low
1927-39	.4384	.2507
1948-61	.8035	.4643

* The impact is measured as of the second year after the change in retentions. The long-run effects are not very different for most of the equations (See Table V-4).

Note: (See variables following Table V-6.)

TABLE V-4

IMPACT DURING SECOND YEAR AND LONG-RUN IMPACT OF A PERMANENT ONE DOLLAR INCREASE IN GROSS RETENTIONS

Equation	Impact During Second Year	Long-Run Impact
Period 1948-61		
Model I Lagged	46¢	54¢
Model I Averaged	60¢	73¢
Model II Lagged	80¢	156¢
Period 1927-39		
Model I Lagged	43¢	41¢
Model I Averaged	25¢	28¢
Model II Lagged	44¢	42¢

Note: (See variables following Table V-6.)

The lower values of the coefficients of the retention variables in the prewar period may reflect a desire to use retained earnings for debt reduction during the adverse conditions of the 1930's. The coefficients on the utilization variable were also lower in the prewar period, however, which suggests an alternative explanation. Under the adverse conditions of the 1930's, a large part of the investment that was made was probably "autonomous" in the sense that it was related to major technological developments and innovations. With a large gap between potential and actual output, and gross retentions at a very low level, the response of investment to changes in these variables was correspondingly weak.

Of the models estimated, the capital stock adjustment model with the independent variables averaged over the current and preceding years gives the best results for both periods.

As for the coefficient on the capital stock, let us examine the best investment function fitted to annual data for the postwar period. This is

the equation using the value of the independent variables averaged over the current and preceding years:

$$I_t = -.4162 + .5965\ \text{Ret} - .9675\ \text{Gap} + .1805\ K_{t-1} \qquad (R^2 = .96)$$

At first glance, this function appears peculiar, as the sign of the capital stock is the opposite to that obtained in the usual stock adjustment model. However, in the formulation used, the positive sign on the capital stock variable makes sense, since the variable $(Q_t^a - P_t^a)$ would pick up the negative effect of an increase in capacity upon investment. 8/

It is not surprising that an increase in K, given the gap between actual and potential output, has a positive effect upon investment. The dependent variable, being gross investment, includes replacement investment, which is positively related to the size of the capital stock. As replacement investment could account for as much as 10% of the capital stock, a substantial portion of the estimated positive effect of the capital stock is simply explained. 9/

Aside from replacement investment, an increase in K, given Q and P, indicates that the capital intensiveness of production has increased. Under these conditions one would expect larger investment in relation to capacity requirements, as measured by $(Q^a - P^a)$.

These two factors would appear to explain the coefficient of 0.18 obtained for the capital stock. However, as the capital stock is dominated by trend, it could also serve as a proxy for other trend dominated variables.

Taken as a whole, these results suggest that retained earnings do have a significant impact upon investment and point toward rejection of a simple output-capacity accelerator model. However, the statistical problems involved in these data do not permit a precise estimate of the effect of retentions (or of utilization) upon investment.

Estimates of the effect of corporate taxes upon investment must necessarily be even less precise. The observed changes in retentions reflect changes in corporate tax rates and changes in allowable depreciation rates (as well as other variables). The effect of an increase in depreciation upon investment may well be greater than the effect of an ordinary corporate tax cut. Consequently, we cannot use the coefficients in Table V-1 to predict the effects of either type of tax change, since they reflect, in part, a mixture of both. 10/

Partial Correlation with Monetary and Tax Variables

Partial Correlations of investment with the marginal corporate tax rate, the rate of interest, and the money supply are presented in Table V-5. In no instance is either of the monetary variables statistically significant. In view of the poorness of the measures we have used, and in view of certain statistical difficulties with monetary variables in investment models, these results can hardly be regarded as conclusive. 11/ Furthermore, the more adequately specified quarterly models described below yielded opposite results.

Investment is significantly positively related to the corporate tax rate in the postwar years. This result is puzzling at first glance, but it may well be a reflection of the differential impact of taxes and depreciation upon investment. If a dollar reduction in tax liability has

TABLE V-5

PARTIAL CORRELATIONS OF INVESTMENT WITH TAX AND MONETARY VARIABLES: ANNUAL DATA, PREWAR AND POSTWAR PERIODS

Model I: $I_t = a + b\ Ret + c\ Gap + d\ K_{t-1}$

Period	Timing	Partial Correlations (t values) Marginal Tax Rate	Interest Rates	Money Supply
1948-61	Lagged	.675 (2.75)	-.485 (1.66)	-.110 (0.33)
1948-61	Averaged (Note Lagged for M and r)	.558 (2.02)	.424 (1.40)	-.412 (1.36)
1927-39	Lagged	.1040 (0.30)	.269 (0.79)	.145 (0.42)
1927-39	Averaged	-.140 (0.40)	.511 (1.63)	.193 (0.56)

Model II: Same as Model I, K_{t-1} replaced by I_{t-1}

1948-61	Lagged	.795 (3.93)	-.172 (0.52)	-.282 (0.88)
1927-39	Lagged	.093 (0.26)	.324 (0.97)	-.039 (0.11)

Note: See variables following Table V-6.

less of an impact upon investment than a dollar increase in depreciation, the tax rate would reveal a positive partial correlation with investment. Over the postwar period the tax treatment of depreciation was liberalized while tax rates on net income rose.

Supplementary Evidence

1. Realization functions

The investment forecasts published in Public and Private Investment have also been investigated. These forecasts predict the change in investment quite well, as is apparent in the first equation listed in Table V-6.

"Realization functions", which relate the difference between the investment forecast and the investment actually realized to changes in output and retention, were also fitted. In the second equation in Table V-6, the difference between the actual increases and the predicted change in current dollars is a function of changes in prices of capital goods, retentions and output. The price and output variables are highly significant; the retentions variable, while having the expected sign, is not statistically significant.

In addition, the short-run effect of interest rates is also examined. However, as is shown by the partial correlation coefficients reported in Table V-6, changes in the rate of interest are not significant in either realization function.

In the third equation, the difference between forecast and realized investment in constant dollars is a function of changes in retentions and output. Both retentions and output are statistically significant, which suggests that the lower significance of the retentions variable in the second equation may be explained by the collinearity between capital goods prices and retentions.

These results suggest that the short-run impact of changes in retentions as well as changes in output upon investment is important. They are,

TABLE V-6

AGGREGATE INVESTMENT FORECAST AND REALIZATION FUNCTIONS

Period 1948-63

I. Forecast Functions:

$$I^*_t / I^*_{t-1} = -.2341 + \underset{(11.13)\,//}{1.2309}\ I^F_t / I^P_{t-1}$$

$\bar{R}^2 = .88$

Sest = .043

DW = 2.05

$$I^*_t / I^*_{t-1} = -.9729 + \underset{(9.01)\,//}{1.0306}\ I^F_t / I^P_{t-1} + \underset{(2.84)}{.9168}\ \frac{Pt}{Pt-1}$$

$\bar{R}^2 = .92$

Sest = .035

DW = 2.65

II. Realization Functions:

$$\left(\frac{I^*t}{I^*t-1} = \frac{I^F_t}{I^P t-1}\right) = -1.9624 + \underset{(6.13)\,//}{.9202}\ \frac{Pt}{Pt-1} + \underset{(1.29)}{.0779}\ \frac{Ret(t)}{Ret\ t-1}$$

$$+ \underset{(3.57)\,//}{.9006}\ \frac{GDP\ t}{GDP\ t-1}$$

$\bar{R}^2 = .81$

Sest = .020

DW = 2.23

Partial Correlations:

Variable	Partial
rt/r t-1	.13 (0.43)

$$I_t - \frac{I^F\ (t-1)}{P\ (t-1)} = -4986.68 + \underset{(1.99)\,/}{571.01}\ \frac{Ret(t)}{Ret\ (t-1)} + \underset{(3.75)\,//}{4210.12}\ \frac{GDP\ t}{GDP\ t-1}$$

$\bar{R}^2 = .68$

Sest = 91.12

DW = 1.55

Partial Correlations:

Variable	Partial
rt/r t-1	-.14 (0.48)

Glossary of Symbols:

I*t = Final Actual Investment in Current Dollars

I^F_t = Forecast Investment in Current Dollars

I^P_t = Preliminary Est. of Investment in Current Dollars

I_t = Actual Investment (Constant Dollars)

P_t = Price Index of Capital Goods

Ret = Retained Earnings (deflated by P_t)

GDP = Real Gross Domestic Product

r_t = Long term Rate of Interest

Note: / Statistically significant at 95% level of confidence.

// Statistically significant at 99% level of confidence.

See variables on following page.

VARIABLES USED IN THE ANALYSIS OF INVESTMENT (TABLES V-1 - V-6)

I Gross business fixed investment in 1949 dollars. This is the sum of producers' investment in equipment and non-residential construction published in the National Accounts.

Ret Gross cash retentions in 1949 dollars. This is the sum of corporate retained earnings and corporate capital consumption allowances published in the National Accounts, deflated by the implicit deflator for gross business fixed investment.

GAP Potential minus actual PNF capital output (in 1949 dollars). The derivation of this series is described in Appendix B.

K PNF capital stock (in 1949 dollars). This is the series used in the construction of potential output. It is based on unpublished data made available by D.B.S.

The marginal corporate tax rate. The variable used was the statutory federal marginal rate for large corporations, plus the average effective Provincial tax rate based upon National Accounts data.

The rate of interest. The variable used is the long-term rate of interest on government bonds calculated from various series published by the Bank of Canada.

Money supply. This is currency plus deposits (excluding government deposits) published by the Bank of Canada.

therefore, consistent with the findings based on the annual investment functions.

2. Quarterly Investment Functions

Recent studies in the United States have domonstrated the importance of an adequate specification of the lag structure of the investment process. When the lag between appropriation and expenditure is taken into account, a significant effect of the cost of capital or the rate of interest upon investment is detected. In a companion study, 12/ one of the authors has fitted a model to postwar quarterly data which reveals a significant impact of the cost of capital upon investment. This finding is quite robust with respect to changes in the specification of the lag structure and to alternative measures of the cost of capital and other variables.

Summary of Investment Results

On the basis of the empirical evidence examined in this chapter, it appears that a simple accelerator model is an inadequate description of investment behaviour. The results obtained in the different annual models fitted lend support to the hypothesis that gross retained earnings have an important impact upon investment.

The annual models yielded consistently insignificant results for the monetary variables, but this may merely reflect statistical estimation problems. The quarterly findings presented in the companion study indicate that the cost of capital—whether measured by the market rate of interest or by the rate of interest adjusted for effective tax rates and changes in capital goods prices—has a significant impact upon investment. This result is consistent with the findings of a number of recent studies of investment behaviour in the United States. Consequently, we have given this finding

greater weight than the insignificant results obtained from our analysis of annual data.

Taken as a whole, this empirical evidence is consistent with the hypothesis that the corporate tax structure does affect investment decisions. Let us now turn to an examination of the effects of taxation upon savings decisions.

B. CORPORATE SAVINGS

In the light of the findings of the previous section, changes in corporate savings or retentions are likely to provide some direct stimulus to business fixed investment as well. In addition, as gross corporate savings accounts for the lion's share of domestic savings, an examination of its determinants is an important part of the analysis of the propensity to save.

The analysis of retentions is based upon the well known model of dividend behaviour developed by Lintner. 13/ This model postulates that dividends react slowly to changes in profits, and hence that dividends depend on current profits and past dividends. Lintner examined alternative theories of dividend behaviour using a variety of evidence, but found that no other model worked nearly so well.

One important question which we shall examine is the role of changes in capital consumption allowances. The issue here is whether firms treat an increase in their after-tax cash flow brought about by liberalization of capital consumption allowances in the same way as an increase in after-tax cash flow brought about by tax cuts. As the present system of accelerated

capital consumption allowance rates was instituted in 1949, it will be instructive to compare the dividend equations fitted to the prewar and postwar periods. If firms pay out the same fraction of capital consumption allowances as they do of net profits, the coefficients of the cash flow model should be relatively stable and those of the net profits model relatively unstable between the two periods. If firms tend to retain all, or almost all, of increases in capital consumption allowances, then the coefficients of the net profits model should be relatively stable and those of the cash flow model relatively unstable.

We therefore estimated two versions of the basic Lintner model, using profits net and gross of depreciation through the prewar and postwar periods. In order to determine whether corporate or personal tax rates affected dividend behaviour, partial correlations are calculated for appropriate corporate and personal tax rates.

These results, which are tabulated in Table V-7, show that both versions of the Lintner model yield reasonable (though not outstanding) explanations of dividend payments in both the prewar and postwar periods. Both tax variables are insignificant in each of these equations.

Although both the net profits and gross profits versions of the Lintner model yield about the same goodness of fit, the coefficients of the gross profit model are more unstable between the two periods. The

TABLE V-7

DIVIDEND FUNCTIONS

I AGGREGATE DIVIDENDS

Period	Profit Variable (After Corporate Tax)	REGRESSION EQUATION (t values in Brackets)								
		Constant	D_{t-1}	Π_t	$\bar{R}^2$	Sest	D.W.	Partial Correlation with Marginal Tax Rates: Personal	Partial Correlation with Marginal Tax Rates: Corporate	Long-Run Marginal Payout Ratio
PRE-WAR	NET	29.97	.6680 (4.83)	.1578 (4.47)	.7878	21.29	2.00	.0418 (.13)	-.2793 (.87)	.4753
	GROSS	6.93	.6148 (4.34)	.1470 (4.23)	.7851	21.42	1.90	.2029 (.62)	-.1525 (.46)	.3816
POST-WAR	NET	-59.60	.5961 (3.55)	.2442 (2.75)	.8155	62.17	1.58	-.0694 (.22)	-.2307 (.75)	.6046
	GROSS	129.58	.4904 (2.10)	.0837 (2.19)	.7837	67.33	1.44	.1073 (.34)	-.3168 (1.06)	.1642

Note: See variables following Table V-10.

VARIABLES USED IN THE ANALYSIS OF DIVIDENDS
(TABLES V-7 - V-10)

Dividends, Dividends paid to residents, Dividends paid to non-residents, Net Profits after tax, and Gross Profits (net profits after tax plus corporate capital consumption allowances) are drawn from the National Accounts.

The marginal tax rate applicable to dividends is constructed on the basis of the statutory rate structure for the personal income tax, each marginal tax rate being weighted by the proportion of dividends accounted for by the relevant tax bracket, after deduction of the dividend credit.

The marginal tax rate for corporations is the statutory federal rate for large corporations plus the effective provincial tax rate calculated from data in the National Accounts.

estimated short-run marginal payout ratio in the postwar period is only one half that of the prewar period, and the estimated long-run marginal payout ratio is reduced by more than one half.

In contrast, in the net profits model the short-run marginal payout ratio rose by 55%, and the long-run payout ratio rose by 27% between the two periods.

Table V-8 presents a tabulation of tests of the statistical significance of these changes in the coefficients. As is apparent, the differences observed between the payout ratios in both models are not statistically significant. This means that neither the hypothesis that corporations return 100% of capital consumption allowances nor the hypothesis that they retain the same proportion of capital consumption allowances as of net profits can be rejected on the basis of these tests.

However, the t values for both the short-run and long-run marginal payout ratios are smaller for the net profits model, thus confirming the earlier observation that this model revealed greater stability between the two periods. In addition, the long-run marginal payout ratio of 0.16 obtained for the postwar period for the gross profits model is unreasonably low.

On the basis of these considerations, the net profits model would appear to have greater validity than the gross profits model. However, a model incorporating a payout ratio for capital consumption greater than zero, but less than the payout ratio for net profits, would likely yield a greater stability of short-run and long-run payout ratios.

Such a mixed model as well as the net profits model would imply, of course, that a liberalization of capital consumption allowances would lead

TABLE V-8

t TESTS FOR CHANGES IN COEFFICIENTS
OF DIVIDEND FUNCTIONS

I AGGREGATE DIVIDENDS

Profit Variable	Coefficient For	Difference	σ Diff	t Test
NET	D_t-1	-.0719	.2175	-.3306
	π	.0864	.0956	.9038
	L	.1293	.4954	.2610
GROSS	D_t-2	-.1244	.2731	-.4555
	π	-.0633	.0517	-1.2244
	L	-.2174	.2341	-.9287

Note: The standard error of the estimate of L was estimated approximately by taking a Taylor series expansion of $\hat{L} = \frac{\hat{\gamma}}{1-\beta}$ about the true values of L, γ and β, where $\hat{\gamma}$ and $\hat{\beta}$ are the regression coefficient estimates of γ and β.

See variables following Table V-10.

to a larger increase in gross corporate retentions than would a corporate tax rate reduction which has the same effect on corporate cash flow.

These aggregate regression functions support the hypothesis that dividend payments are insensitive to both corporate and personal tax rates. This means the effect of corporate taxation upon dividends is fully a result of the impact of corporate taxes upon corporate profits after tax. If a change in corporate tax rates leads to a change in corporate profits after tax, dividends and retentions will bear the tax in about equal proportions in the long run.

In the aggregate functions, dividends paid to foreigners and dividends paid to residents are lumped together. There is little reason to believe that these two types of payments should be explained by a single model. The industrial distribution of companies which are primarily foreign owned differs markedly from that of resident-owned companies. Furthermore, the remission of dividends from wholly owned subsidiaries to parent companies need not be explained by the Lintner model.

Since the response of the two dividend streams to current profits may differ and since the tax variables are more relevant for dividends paid to residents, the aggregate functions may have blurred the effects of the tax variables. Separate equations explaining each of these dividend streams are therefore estimated for each of the periods.

The results are tabulated in Table V-9. The response of dividends to residents to changes in profits was quite slow in the prewar period, quite quick in the postwar period. The opposite was true for dividends to foreigners. In the prewar period these payments depended upon current profits, the

TABLE V-9

DIVIDEND FUNCTIONS

II DIVIDENDS PAID TO RESIDENTS

Period	Profit Variable (After Corporate Tax)	REGRESSION EQUATION (t Values in Brackets)								
		Constant	D_{t-2}	π_t	$\bar{R}^2$	Sest	D.W.	Partial Correlation with Marginal Tax Rates: Personal	Partial Correlation with Marginal Tax Rates: Corporate	Long Run Marginal Pay-out Ratio
PRE-WAR	NET	13.75	.7496 (4.59)	.0777 (2.75)	.6446	17.20	1.91	-.0985 (.30)	.0537 (.16)	.3103
	GROSS	-0.67	.7238 (4.56)	.0735 (2.91)	.6625	16.76	1.91	.0106 (.03)	.1652 (.50)	.2661
POST-WAR	NET	-47.55	.4685 (1.96)	.1743 (2.37)	.7389	44.71	1.89	-.2290 (.74)	-.0618 (.20)	.3279
	GROSS	77.25	.2739 (.92)	.0695 (2.47)	.7465	44.05	1.63	.0618 (.20)	-.2142 (.69)	.0957

Note: See variables following Table V-10.

TABLE V-9 (continued)

DIVIDEND FUNCTIONS

III DIVIDENDS PAID TO NON-RESIDENTS

Period	Profit Variable (After Corporate Tax)	REGRESSION EQUATION (t Values in Brackets)								
		Constant	D_{t-2}	π_t	$\bar{R}^2$	Sest	D.W.	Partial Correlation With Marginal Tax Rates: Personal	Partial Correlation With Marginal Tax Rates: Corporate	Long-Run Marginal Payout Ratio
PRE-WAR	NET	43.10	.1314 (.62)	.1110 (3.89)	.5821	15.86	2.47	-.0201 (.06)	-.4178 (1.38)	.1278
	GROSS	23.63	.0340 (.16)	.1094 (4.14)	.6123	15.27	2.46	.1027 (.31)	-.3209 (1.02)	.1133
POST-WAR	NET	-14.44	.6181 (4.08)	.0977 (2.68)	.7678	29.93	1.55	.1853 (.60)	-.1100 (.35)	.2611
	GROSS	67.04	.5583 (2.70)	.0284 (1.86)	.7077	33.58	1.52	.2387 (.78)	-.1477 (.47)	.0643

Note: See variables following Table V-10.

role of lagged dividends being minimal. In the postwar period, however, they responded and rose more slowly to current profits.

That the relative stability of short-run and long-run payout ratios of dividends to residents for the net and gross profits models may be improved is also apparent in Table V-9. The net profits model yields a stable long-run and unstable short-run payout ratio. The gross profits model yields the opposite. However, none of the estimated changes in payout ratios is statistically significant. 14/

Among these rather mixed results one persistent phenomenon is observed—both tax variables are insignificant in every case. In the case of dividends remitted to foreigners, this is to be expected. The marginal personal tax rate in Canada is irrelevant, and the corporate tax rate used is an imperfect measure of the taxation borne by these dividends. For dividends to residents, on the other hand, the tax variables used are more appropriate. Even for these payments, however, corporate and personal tax rates are of little importance.

These results lend support to the hypothesis that the payout ratio of dividends from after-tax profits is not affected by either the marginal personal tax rate applicable to dividends or to the marginal tax rate on corporate profits. This means that taxation affects dividend payments only by affecting after-tax profits. In so far as after-tax profits <u>are</u> affected by corporate tax changes, 15/ dividends bear a share of the tax burden proportionate to their share in after-tax profits—that is, a dollar of dividends will bear about the same burden of tax as a dollar of retained earnings.

The bulk of an increase in cash flow brought about by a liberalization of capital consumption allowances, on the other hand, is likely to be retained.

A reduction in capital consumption allowance rates will, therefore, likely bear more heavily on corporate savings than upon dividends.

TABLE V-10

t TESTS FOR CHANGES IN COEFFICIENTS OF DIVIDEND FUNCTIONS PREDICTING DIVIDENDS PAID TO RESIDENTS

Profit Variable	Coefficient	Difference	σ Diff.	t test
Net	D_{t-1}	-.2811	.2895	-.9710
	Π_t	.0966	.0788	1.2259
	L	.0176	.3499	.0503
Gross	D_{t-1}	-.4499	.3374	1.3334
	Π_t	-.0040	.0378	-.1058
	L	-.1704	.1916	-.8894

Note: See variables following Table V-7.

C. PERSONAL SAVINGS

Over the period from 1926 to the present many important changes have occurred in the Canadian economy. Per capita real income has more than doubled, the relative importance of agriculture today is one third that of 1926, government expenditure and taxation relative to GNP have doubled, and price levels have risen by more than 50%. These and many other far-reaching changes could have important effects upon the consumption behaviour of individuals.

Yet, over the whole period, with the exception of the war and depression years, personal consumption exceeded 96% of disposable income in only one year and fell short of 91% of disposable income in only one year. During

the postwar period, 1947-63, consumption lay within 91% and 95% of disposable income without exception.

Table V-11 below compares the average consumption/income ratio for four markedly different periods. Aside from short-run fluctuations (which will be discussed below) the stability of the consumption/income ratio has broken down only in the depths of the great depression, when households lived beyond their income in an attempt to maintain pre-depression living standards, and during the years of World War II, when rationing, shortages and patriotic pressures for savings restricted consumption to abnormally low levels.

TABLE V-11

AVERAGE CONSUMPTION/INCOME RATIOS
FOR FOUR PEACETIME PERIODS

Period	Average Consumption/ Income Ratio	Range
1926-29	.95	.12
1937-41	.96	.08
1947-53	.93	.04
1954-63	.94	.04

Source: Based on Consumer Expenditures and Disposable Income Reported in the National Accounts.

Whether the stability of the average propensity to consume is due to offsetting effects of changes in the determinants of consumption or to the weakness of the influence of these determinants is difficult to determine. In the

following sections the available time series and cross-sectional evidence will be examined in order to shed some light on this question.

Cross-Section Evidence: The Role of Income Distribution

The effect of the distribution of income upon consumption is of particular importance in the analysis of the effect of taxation upon the consumption rate. Some redistribution of income from the relatively rich to the relatively poor is a widely accepted goal for the tax-transfer system. It is important to know whether such a redistribution, if achieved, will have an adverse impact upon personal savings and, if so, to measure its importance.

Table V-12 below presents some tabulations based upon the 1959 Survey of Consumer Expenditures. These reveal that families with incomes below $4,000 typically spend more than their disposable income, families with incomes between $4,000 and $8,000 save less than 10% of their disposable income, while families with incomes above $8,000 save more than 10% of their disposable income.

These results are hardly surprising and appear, at first glance, to support the view that taxation of the rich will bear more heavily upon savings than taxation of the poor. In order to measure the impact of income redistribution upon aggregate savings, however, we need to measure the marginal rather than the average propensity to save. This is shown in Column 8 in Table V-12. These figures reveal that the share of savings in a dollar increase in income varies greatly between income classes, but shows no pronounced tendency to increase with income. Those in the richest income groups save 26 cents out of a dollar increase in income; those in the four

TABLE V-12

CROSS SECTIONAL MARGINAL PROPENSITY TO SAVE
BASED ON 1959 CONSUMER EXPENDITURE SURVEY *

Before-Tax Income Class $	(1) Mean Disposable Income Per Family	(2) ΔDY	(3) 3 Point Mov. Avg. of ΔDY	(4) Mean Saving and Security Exp.	(5) ΔS	(6) 3 Point Mov. Avg. of ΔS	(7) MPS: ΔS/ΔDY	(8) MPS: Based on Mov. Avg.
Under 2,500	1842			-400				
		880			188		.214	
2,500 - 2,999	2722			-212				
		461	1776		-81	303	-.176	.171
3,000 - 3,499	3183			-293				
		435	1354		196	263	.451	.194
3,500 - 3,999	3618			-97				
		458	1326		148	361	.323	.272
4,000 - 4,499	4076			51				
		433	1352		17	213	.039	.158
4,500 - 4,999	4509			68				
		461	1301		48	254	.104	.195
5,000 - 5,499	4970			116				
		407	1439		189	423	.464	.294
5,500 - 5,999	5377			305				
		571	1850		186	473	.326	.256
6,000 - 6,999	5948			491				
		872	2662		98	519	.112	.195
7,000 - 7,999	6820			589				
		1219	5413		235	1191	.193	.220
8,000 - 9,999	8039			824				
		3322			858		.258	
10,000 & over	11,361			1682				

* Families of 2 or more

Source: D.B.S., Urban Family Expenditure 1959, and unpublished data made available by D.B.S.

95937—11½

lowest income groups save on the average 20 cents out of a dollar increase in income. According to these figures, a transfer of a dollar from the poor to the rich would yield an increase in personal savings of only 6 cents.

This means that massive redistribution of income would have only a small effect upon personal savings. For example, suppose that the income tax upon taxpayers with more than $8,000 was lowered until these taxpayers paid the same rate of tax as other income taxpayers, the loss of revenue being made up by increasing taxes on lower income taxpayers. In 1960 this would have meant a transfer of personal income tax burden of $336 million. 16/ The above calculations indicate that this redistribution of the income tax burden would have yielded an increase in personal savings of only $20 million.

However, there is good reason to believe that the marginal propensities to save on which these calculations are based are biased. The typical marginal propensity to save based upon these cross-section data is about 0.20. The marginal propensity to save based upon time series data is only about 0.06. This difference is a result of two factors:

(a) Transitory influences upon family income. The low income groups include families whose income is temporarily below normal, and who will spend a larger fraction of their income to maintain their customary living standard. The high income groups include families with income temporarily above normal who will save this extra income to be used when their income is lower. 17/

(b) The effects of the family's relative income position is in its spending. Families with the same money income will spend more of it as the consumption of other families increases. Consequently, an increase in a

family's income will lead to higher consumption spending when the income of other families is also rising than when the income of other families is constant. 18/

While the operation of these factors will cause an upward bias to the MPS estimated for every pair of adjacent income groups, the bias is likely to be larger for income groups in the middle and lower ranges. In particular, the contribution of transitory factors to the large income difference between the top two income groups is likely to be relatively small, and the bias in the estimate of the MPS will, therefore, be smaller. 19/

In order to obtain a maximum estimate of the effect of income redistribution of savings, we have assumed that the MPS of the two top income groups equals 0.26 and that the MPS of families in the rest of the income distribution is 0.05, which is almost equal to the average propensity to save for the middle and lower income groups as a whole. Under these assumptions the differences between the two MPS's is 0.21. The same redistribution of the tax burden described above would now yield a modest increase in savings of almost $70 million.

These cross-section findings are supported by time series statistical analysis. In a number of consumption equations for the postwar period, separate marginal propensities to consume for different types of income—transfer payments, wages and salaries, and business income—are estimated. Usually, the differences between the MPC's are not statistically significant (see Table V-13). Because of a variety of statistical problems with these data and models, these results are not conclusive. Taken together with the analysis of the cross-sectional data, however, they do suggest that changes in the distribution of income do not have strong effects upon savings rates.

TABLE V-13

SELECTED TIME SERIES CONSUMPTION FUNCTIONS

A. Annual data, prewar period (1927-39)

Regression Equation:

$$C_t = 59.47 + \underset{(8.63)}{.6230}\ \Delta DY_t + \underset{(6.42)}{.4773}\ DY_{t-1} + \underset{(3.42)}{.4459}\ C_{t-1}$$

$\bar{R}^2 = .97$ DW = 0.77

Partial Correlations:

Variable	Partial	(t value)
ΔM_t	-.17	(0.49)
M_{t-1}	-.52	(1.72)
DT/Y	-.53	(1.78)
It/C*	-.57	(1.99)
Δr_t	.51	(1.58)
r_{t-1}	.08	(0.21)

Regression Equation:

$$C_t = 235.74 + \underset{(10.17)}{.6729}\ DY_t$$

$\bar{R}^2 = .89$ DW = 0.59

Partial Correlations:

Variable	Partial	(t value)
r_t	.51	(1.87)
DT/Y	-.33	(1.09)
IT/C*	-.77	(3.88)
M_t	-.51	(1.81)

B. Annual data, postwar period (1948-62)

Regression Equation:

$$C_t = 9.67 + \underset{(3.62)}{.9253}\ \Delta DY_t + \underset{(2.06)}{.7513}\ DY_{t-1} + \underset{(0.49)}{.1877}\ C_{t-1}$$

$\bar{R}^2 = .95$ DW = 1.48

Partial Correlations:

Variable	Partial	(t value)
ΔM_t	.57	(2.19)
M_{t-1}	-.51	(1.88)
DT/Y		
IT/C*	-.13	(0.43)
Δr	-.10	(0.31)
r_{t-1}	-.17	(0.52)

Regression Equation:

$$C_t = -0.67 + .9355\ DY_t$$

$\bar{R}^2 = .96$ DW = 1.27

Partial Correlations:

Variable	Partial	(t value)
r_t	-.20	(0.71)
DT/Y		
IT/C*	-.02	(0.08)
M_t	-.13	(0.44)

C. Quarterly data, postwar period

Regression Equation (Seas. Adj.; Per Capita, 4702-6204):

$$C_t = 171.83 + \underset{(5.46)}{.6175}\ \Delta NFY + \underset{(4.94)}{.4239}\ NFY_{t-1} + \underset{(3.73)}{.4318}\ C_{t-1}$$

$\bar{R}^2 = .99$ DW = 2.14

Partial Correlations:

Variable	Partial	(t value)
DT	.11	(0.84)
Bus Y/NFY	-.02	(0.16)

Regression Equation (Seas. Adj.; Per Capita, 4802-6204):

$$C_t = 185.17 + \underset{(4.99)}{.6114}\ \Delta NFY + \underset{(4.36)}{.4574}\ NFY_{t-1} + \underset{(2.79)}{.3870}\ C_{t-1}$$

$\bar{R}^2 = .99$

Partial Correlations:

Variable	Partial	(t value)
Liquid Assets	-.10	(0.71)
Pers. Loans	.06	(0.42)
r_{t-1}	-.16	(1.23)
M_{t-1}	-.01	(0.07)
(Liquid Assets-Loans)	-.11	(0.80)

Note: See variables on following page.

VARIABLES USED IN THE TIME SERIES ANALYSIS OF CONSUMPTION
(TABLE V-13)

C Personal consumption expenditures (constant dollars).

DY Personal disposable income (constant dollars).

NFY Non-farm disposable income (constant dollars).

DT Personal direct taxes.

IT Indirect taxes.

C* Consumption expenditures in current dollars.

Bus Y Business income plus net rental income plus interest income of persons.

Y Personal income.

(All of the above variables are drawn from National Accounts. All constant dollar figures refer to 1949 dollars for the annual data, and 1957 dollars for the quarterly data.)

MP The money supply. This is currency plus bank deposits (excluding government deposits) published by the Bank of Canada.

r Long-term rate of interest based upon various series published by the Bank of Canada.

Liquid assets. This is the sum of personal savings deposits and Canada Savings Bonds published by the Bank of Canada.

Consumer debt. This is the sum of personal loans and consumer instalment credit published by the Bank of Canada.

Long-run and Short-run Time Series Evidence:
The Role of Other Variables

In addition to income distribution, it would be useful to examine the effect of monetary variables, tax variables, and the past levels of consumption and income upon current consumption. The available cross-sectional evidence can, of course, shed little direct light on the effect of these variables. Therefore, time series analysis is relied upon.

Various regression functions have been fitted to annual data for the prewar (1926-39) and postwar (1948-62) periods. In addition, a variety of equations are fitted to quarterly data for the postwar period. These results are tabulated in Table V-13. We shall discuss the importance of each set of variables in turn.

Monetary Variables

Financial variables can influence consumption expenditure in three ways:

1. The wealth effect. If the stock of real wealth owned by households is unchanged, an increase in the real value of financial assets will increase the total wealth of households. Like an increase in income, such an increase in wealth should stimulate consumption.

2. The liquidity effect. An increase in the stock of liquid assets held by consumers relative to other assets may lead to a reduction in consumer savings.

3. The rate of return effect. A decline in the rate of interest will lower the reward on savings and may therefore lead to a reduction in savings.

In the long-run analysis of annual data, the effect of two variables is examined: the rate of interest of government bonds, and the stock of currency and chartered bank deposits. The former is a measure of the general level of interest rates; the latter is a crude proxy for the stock of money held by the household sector.

These variables are imbedded in a variety of models reflecting different specifications of the time of the effect of income on consumption.

In all trials except one, neither the interest rate nor the real stock of money had a significant effect upon consumption. Whatever effect was observed was usually in the wrong direction, especially for the prewar period. In the postwar period, the change in the money supply had a significant positive effect in one model. This might be taken to indicate that the money supply has a short-run influence upon consumption, reflecting the liquidity effect of changes in the money supply. However, the long-run marginal propensity to consume becomes unreasonably low (0.80) after the change in the money supply is introduced, which casts suspicion upon this interpretation.

For the postwar period, somewhat richer (though far from ideal) data is available. Partial correlations of the following variables were calculated for a simple distributed lag model of consumption fitted to quarterly data:

Consumer liquid assets (Canada Savings Bonds plus personal savings accounts)

Consumer debt

Money supply

Long-term interest rate

Liquid assets minus consumer debt

None of these variables is statistically significant in either the raw or seasonally adjusted versions of the model.

The findings suggest that the impact of monetary variables upon consumer expenditures has not been great. They must be regarded as extremely tentative, however, since the available measures match the theoretical concepts very poorly, and since the usual time series statistical problems are particularly acute. 20/

Tax Variables

The importance of indirect taxes in relation to direct taxes as a determinant of personal savings has recently received increasing attention in both the popular press and the academic literature. It was a major item on the agenda of the recent Brookings Conference on the general topic of direct and indirect taxes. 21/

The consequences for over-all savings of changing the relative importance of direct taxation of business will be examined later, drawing upon the results presented in the previous section. At this point we shall focus upon the effect of a shift from direct personal taxes to indirect taxes. The argument that such a shift will increase the savings base is based upon two points:

1. Indirect taxes bear more heavily upon low income groups who save little.
2. Indirect taxes do not bear upon savings, provided that investment goods are not subject to these taxes.

We have argued above that the quantitative impact of income redistribution upon personal savings is quite small. A very large shift of the burden of taxation onto the poor would be required to obtain a modest increase in savings.

As for the second point, it is correct, but quantitatively insignificant for a permanent tax change. If a saver is interested in accumulating real wealth as measured by consumer goods, a reduction in his income tax of 20%, and an increase in sales tax on all consumer goods of 20%, will have the same effect on this consumption as a 25% rise in the interest rate, that is, a rise, for example, from 4% to 5%. 22/ All that the saver gains under the sales tax is the income tax he would have paid on the yield upon his savings. While that part of his money income saved is no longer subject to tax, the real value of a given dollar of savings is reduced proportionately.

This reasoning does not apply to a saver subject to money illusion, nor to a saver who wants to accumulate wealth measured in terms of capital goods.

If the change in sales tax is regarded as temporary, the effect upon savings would, of course, be quite different. If the sales taxes are rescinded before the savings are consumed, savings would completely escape taxation.

In order to examine the effect of these two types of tax, two tax variables were included in the regression analyses of the prewar and postwar periods: direct personal taxes/personal income, and indirect taxes/consumer expenditure. In the prewar period, the indirect tax rate has a significant negative effect upon consumption only in the simple unlagged models. In none of the distributed lag models is either tax variable significant.

The role of direct taxes was also examined in two models fitted to quarterly data. In the first model, the partial correlation between aggregate consumption and direct tax payments was calculated. In the second,

95937—12½

the partial correlation between per capita consumption and the effective tax rate was obtained. In neither case was the tax variable statistically significant.

These results tend to confirm the analysis based upon cross-section evidence and theoretical reasoning. Over both prewar and postwar periods, the importance of direct relative to indirect taxation for the propensity to consume out of disposable income has not been great enough to be detected statistically. 23/

Previous Levels of Consumption and Income

Both empirical evidence and theoretical reasoning lend strong support to the hypothesis that consumption does not react immediately to changes in income. Time is required to change traditional patterns of consumption spending. Time must elapse before consumers regard an increase in income as permanent rather than temporary. The time series regression equations which we have fitted confirm this hypothesis. Equations which explain consumption by current income alone are inferior to equations which include the previous level of income and the previous level of consumption. The latter model gives superior results for both prewar and postwar annual data; its superiority is even more striking for quarterly postwar data. Because of this superiority, we have given heavier weight to the partial correlation for tax and monetary variables discussed above based upon this model.

The coefficients obtained differ considerably between the prewar and postwar annual models. In the postwar period, the influence of lagged consumption was not statistically significant, whereas in the earlier period lagged consumption had a significant and quantitatively important impact

upon current consumption. This is no doubt explainable by the different behaviour of income in the two periods. In the prewar years income declined sharply in the early 1930's, then rose sharply as recovery from the great depression proceeded. In the postwar period no great declines occurred; income rose steadily with only minor fluctuations around its upward trend. Changes in income under the postwar circumstances are more likely to be regarded as permanent than would changes in income in the prewar situation.

It follows that the precise response of consumption to income will probably be different for large changes in income than for small changes. The coefficients for the postwar period will likely remain valid only so long as the behaviour of income remains relatively stable.

D. SUMMARY

The empirical results presented in this chapter suggest that changes in the tax structure can be used to influence the proportion of GNP saved and invested. The main route by which changes in the tax structure may influence savings on investment is through changes in the tax burden on corporate income. A reduction in the tax burden on corporate source income would stimulate investment in two ways: by increasing the cash flow of corporations and by increasing the marginal after-tax rate of return on investment. The increased cash flow would be an addition to national savings.

As for other tax changes—such as changing the relative importance of personal income and sales taxes or changing the degree of progression

in the personal income tax—these would be unlikely to have a very strong effect on national savings.

The results also point up, once again, the overwhelming importance of aggregate demand. Increases in aggregate demand will raise both savings—as a result of the income effect on personal savings and the retentions stimulated by increased profits—and investment—by increasing the utilization of potential GNP and by increasing the cash flow and rates of return of corporations.

As for monetary policy, the empirical results which are presented in detail in a companion study, 24/ suggest that interest rates do have a significant effect upon investment. The extent to which domestic monetary policy can affect domestic interest rates is a question which lies beyond the scope of this paper.

REFERENCES

1/ To the extent that the rate of capital formation affects either the initiation or the diffusion of new techniques or new products, capital formation will be a more important source of growth than the estimates developed in Chapter II above indicate.

2/ In the absence of compensatory policy moves, the expansion of investment will have two offsetting effects on the balance of payments (and on the exchange rate under a floating exchange rate system). The expansion of demand will worsen the balance of trade; and the rise in interest rates will improve the balance of payments on capital account. With a high degree of international capital mobility, it is possible that an increase in investment would improve the over-all balance of payments while worsening the balance of trade. The available empirical evidence is inconclusive on this issue. The coefficients of the Rhomberg econometric model imply that an increase in autonomous expenditure would appreciate the exchange rate under a floating rate system and improve the over-all balance of payments under a fixed rate system. (R. R. Rhomberg, "An Econometric Model of the Canadian Economy under Fixed and Floating Exchange Rates", Journal of Political Economy, February 1964, pp. 1-31. However, the impact multipliers developed by L. H. Officer on the basis of a more detailed econometric model of the Canadian economy suggest that an increase in autonomous expenditure would have the opposite effect. (L. H. Officer, An Econometric Model of Canada under the Fluctuating Rate, Harvard University Press, forthcoming.)

3/ Under a fixed exchange rate, fiscal policy, including changes in the tax structure, will be the most important set of policy instruments. However, to the extent permitted by constraints on official holdings of foreign exchange, general monetary policy may also be used. There is also some scope for the use of selective monetary policies and for changes in debt management and in government loan programmes. Various combinations of these policies may be used to reduce mortgage lending and to control bank loans without affecting rates of interest on internationally traded securities.

4/ The growth of gross domestic product would not be affected by such a substitution of national for foreign savings. See the discussion of this question in Chapter I, Section B-3 above.

5/ See, for example, the summary of the empirical literature included in Robert Eisner and Robert H. Strotz, "Determinants of Business Investment" in Commission of Money and Credit, Impacts of Monetary Policy, Prentice-Hall, 1963, pp. 140-192.

6/ A summary of the findings of several recent studies of investment in the United States and a presentation of some empirical results for Canada are contained in Thomas A. Wilson, "Capital Investment and the Cost of Capital: A Dynamic Analysis", a study published by the Royal Commission on Taxation.

7/ All tests of significance are based on one-tailed tests when the direction of the possible effect of the variable is known a priori.

8/ The impact of retentions is measured as of the second year after the change in retentions.

9/ In his study of investment for the Brookings model, Jorgensen estimated that replacement investment amounted to about 11% in the manufacturing sector, 4.5% in the regulated industries, and 10% in the remaining sectors. Dale W. Jorgensen, "Anticipations and Investment Behavior", in J. Duesenberry, G. Fromm, E. Kuh and L. Klein, eds., The Brookings Quarterly Econometric Model of the United States, Rand-McNally, 1965, p. 74.

10/ As is pointed out below, otherwise puzzling positive partial correlations between investment and the marginal corporate tax rate may be explainable in these terms.

11/ The monetary variables reflect monetary policy, which is presumably used to offset investment swings which would otherwise occur. Such a policy feedback would introduce or worsen a simultaneous equation bias in the estimated coefficients of the monetary variables for an annual model.

12/ Thomas A. Wilson, op. cit.

13/ John Lintner, "Distribution of Incomes of Corporations Among Dividends, Retained Earnings, and Taxes", American Economic Association Proceedings, May 1956, pp. 97-113.

14/ As the payout ratios tabulated in Table V-9 are payouts from aggregate profits, they will be affected by the proportion of Canadian industry owned by non-residents.

15/ The critical issue here is whether the corporate tax is shifted. See Robert Levesque, The Shifting of the Corporate Income Tax in the Short Run, a study published by the Royal Commission on Taxation.

16/ Based on data published in Taxation Statistics, 1962, Table 2.

17/ This notion has been given its most elegant formulation by Friedman (M. Friedman, A Theory of the Consumption Function, National Bureau of Economic Research, 1957).

18/ The definitive presentation of the relative income hypothesis is that of Duesenberry (J. S. Duesenberry, Income, Savings, and the Theory of Consumer Behavior, Harvard University Press, 1949).

19/ As Friedman has demonstrated, the bias in the long-run marginal propensity to consume estimated by ordinary least squares regression of consumption on income will be proportional to the proportion of the variance of income accounted for by the "transitory" factors. M.Friedman, A Theory of the Consumption Function, National Bureau of Economic Research, 1957, pp. 31-32.

20/ See reference 6 above.

21/ See Otto Eckstein and Vito Tanzi, "Comparison of European and United States Tax Structures and Growth Implications", The Role of Direct and Indirect Taxes in the Federal Revenue System, National Bureau of Economic Research and Brookings Institute, 1964, pp. 217-285.

22/ See Appendix G to Volume 2 of the Report of the Royal Commission on Taxation.

23/ The quarterly postwar results also suggest that consumers respond to changes in disposable income resulting from change in tax payments in the same way as they respond to other changes in disposable income.

24/ Thomas A. Wilson, op. cit. The implications of this finding for changes in the tax structure which affect the marginal rate of return on investment are discussed in Chapter VII below.

CHAPTER VI: AGGREGATE DEMAND AND ECONOMIC GROWTH: FUTURE PROSPECTS

We have now completed our examination of the factors which influence each of the sources of economic growth. In this chapter, we briefly pull together all our findings with respect to the role of aggregate demand, In the following chapter, we discuss the effects of taxation upon economic growth, including a preliminary analysis of the effects of the Royal Commission on Taxation's recommended reforms.

The strong influence of aggregate demand upon the growth of potential output is revealed in two ways:

(a) By examining the impact of aggregate demand upon each of the sources of economic growth, and

(b) By comparing the growth paths of the economy under full employment and under under-employment conditions.

Let us consider each approach in turn.

A. THE EFFECT OF AGGREGATE DEMAND ON THE SOURCES OF ECONOMIC GROWTH

1. Aggregate Demand and the Growth of the Labour Supply

The statistical results presented in Chapter III indicate the influence of the strength of demand upon the various factors which determine the growth of the labour supply. For emignation and immigration the case is reasonably clear-cut. Slack aggregate demand hinders potential immigration and stimulates emigration. Given the political constraints on the rate of

immigration, these losses cannot be easily recouped if they can be recouped at all. At a minimum, potential GNP will be reduced for a long period as a result of the emigrants lost and the immigrants not gained during a period of weak demand.

For participation rates, the case is much less clear. Aggregate demand was not found to be an important direct determinant of participation rates. However, specific industry demands are important—for example, changes in agricultural employment are associated with changes in the participation rates of older and younger males, and changes in employment services are associated with changes in participation rates of females. In so far as the service sector is affected by the level of aggregate demand, then the participation rates of females will likely be affected. However, in this case the loss during a period of stagnation is unlikely to be permanent, as the women will be drawn into the work force at a rapid rate once demand recovers.

As for hours worked, two competing hypotheses appear to be equally valid. The first hypothesis (on the basis of which the estimates of potential GNP were constructed) is that observed hours worked depend on the level of unemployment and a time trend. According to this explanation, fluctuations in hours worked accompany fluctuations in the utilization of potential GNP, but the trend in hours worked does not depend on past levels of utilization.

The rival hypothesis, which is examined in Chapter III, is that the trend in average hours worked is itself explainable in part by the level of aggregate demand. When demand is weak, pressures build up for the instituting of a shorter normal work week. When demand recovers, this

prevents average hours worked from being restored to their previous levels. Hence, periods of weak demand exert a downward ratchet effect on normal hours worked. In view of the importance of trade unions in modern industry, this argument has some appeal. However, it should be noted that the effect of a period of slack demand upon normal hours worked will subsequently gradually diminish during a period of sustained full-employment growth, provided that there is some independent downward secular trend in hours worked. Under these conditions, the ratchet effect serves to accelerate the trend temporarily, but will not lead to a permanent decline which cannot be overcome eventually by the effect of sustained growth at full employment.

2. Aggregate Demand and Technical Change

It is difficult to measure the effect of aggregate demand upon the residual factor, which is why no allowance for such an effect is incorporated in either the estimation of past or future full-employment growth paths. However, the direction, if not the magnitude, of the effect of demand upon the various factors which influence total factor productivity is clear. We discuss each factor in turn.

Economies of Scale

While we have made use of a constant return to scale production function, it is possible that increasing returns to scale in some sectors of the economy will outweigh in importance diminishing returns in other sectors. If this is the case, the more rapid expansion of markets and of the supply of factors of production brought about by more rapid growth of aggregate demand will serve to increase total factor productivity. The

stimulation so provided is likely to be small, however. For example, if a 1% increase in all inputs yields a 1.15% increase in output in the PNF sector, the difference between the full employment and under-employment projections presented in Section C below would be increased by 15%, which would be a contribution to the growth rate of private non-farm output of about 0.07 percentage points. 1/

Structural Change

Inter-sectoral movements of labour provided an important source of economic growth in the past. While the potential gain from the migration from the farm to the city has about been exhausted, other kinds of inter-sectoral movements have potential importance. The existence of income differentials between regions, for example, suggests that an increase in inter-regional mobility could make some contribution to the growth in the future, despite the low contribution made from this source in the past.

In Chapter III, it was estimated that inter-regional shifts contributed 0.02 percentage points to the growth rate in the past. It would not seem unwarranted to assume that, under conditions of continued full employment, the contribution of these shifts would be doubled to 0.04 percentage points.

Finally, it should be mentioned that high employment policies and policies to eliminate structural employment—whether it be regional, occupational or industrial—are complementary. Any reduction in structural unemployment should permit a revision in the target unemployment rate over time, thereby increasing the growth of potential output. For example, if the success of labour market policies permits the gradual achievement of

the 3% unemployment target set by the Economic Council of Canada 2/ within the next seven years, the growth of potential GNP would be increased by about 0.05 percentage points. The chance of success of these policies would be much greater under conditions of full employment.

The Quality of the Labour Force

The stimulus to immigration and the reduction in emigration brought about by strong demand will affect the quality, as well as the quantity, of the labour supply. As was noted in Chapter III, the average quality of both immigrants and emigrants—both in terms of their age-sex distribution and in terms of their occupational distribution and skill level is higher than that of the resident labour force. In the full employment projections presented in Section C below, we assume that net migration would be 25,000 persons per year higher under full employment rather than under under-employment conditions. This would raise the growth rate of the labour force by 0.15 percentage points, and the contribution to the growth of potential GNP is about 0.10 percentage points. If the quality of the migrants is 10% higher on the average, 3/ this would add an additional 0.01 percentage points to the growth of potential GNP.

Pure Technical Change

Technical change more narrowly defined may also be retarded under slack demand conditions. There is a growing body of evidence at the micro level that technical change—at the stage of invention and innovation—is induced rather than exogenous. This means that, while the development of basic science and knowledge may be unaffected by the state of the economy, the development and implementation of commercially feasible applications

of that science does respond to economic conditions. 4/

Furthermore, the effect on productivity of a given technical change is not confined to the period of the original innovation. The speed with which an innovation is diffused through an industry is also important. Under conditions of strong demand with high rates of investment, new process innovations are likely to be diffused more rapidly through an industry. Furthermore, the development of new products will also be encouraged since new products, and particularly new durable products, are likely to be more rapidly acquired by households when incomes are high and growing rapidly.

It is, therefore, likely that the rate of advance of technology and the rate of introduction of new products will be stimulated by a maintenance of full employment rather than under-employment. Unfortunately, however, we are not in a position to make even a crude estimate of the effect of this stimulus on the aggregate growth rate.

A summary of the possible effects of the maintenance of full employment upon those components of the residual factor for which some crude estimates of the effect are possible is contained in Table VI-1. The sum of these effects amounts to 0.15 percentage points which would increase the differential between the growth rates projected in Section C below under high employment and under-employment conditions by about one-third. 5/

3. Aggregate Demand and Capital Formation

Capital formation is the source of growth most clearly affected by the state of aggregate demand. Aggregate demand variables such as the utilization

TABLE VI-1

POSSIBLE EFFECTS OF MAINTENANCE OF HIGH LEVEL EMPLOYMENT UPON FACTORS AFFECTING TECHNICAL CHANGE

Source	Additional Point Contribution to Growth of Potential Under Full Employment Conditions
Realization of Economies of Scale	0.07
Increased Inter-regional Mobility	0.02
Reduction of Structural Unemployment permitting Target Unemployment Rate to be lowered gradually to 3% of Labour Force over a 7-year Period	0.05
Improvement in Quality of Labour Force due to Higher Net Immigration	0.01
TOTAL	0.15
Differential between Full Employment and Under-employment Projections (See Table VI-3 below)	0.47
TOTAL as Percentage of Differential	32%

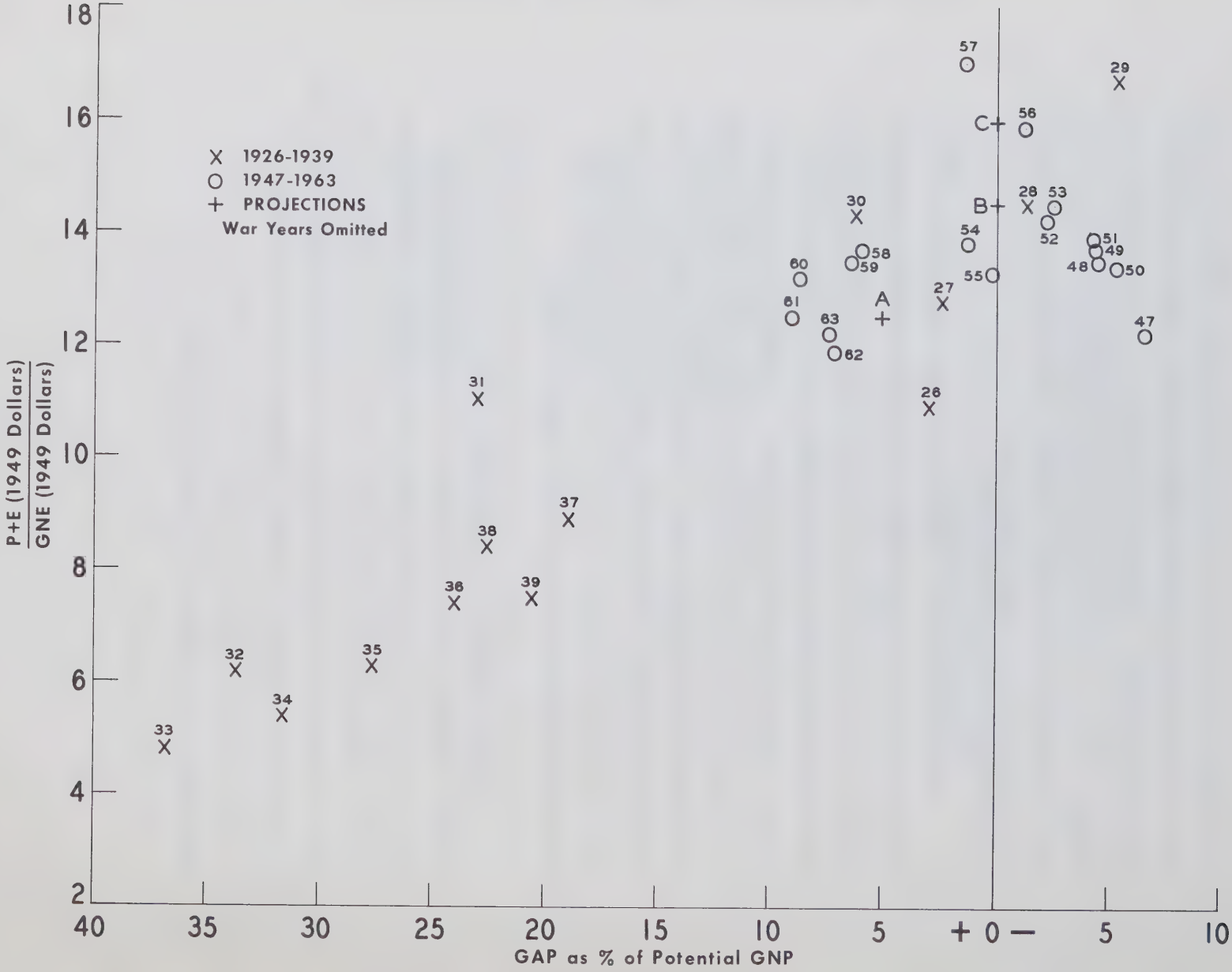
rate itself and the level of gross retained earnings, which varies with the utilization rate, are common elements in most empirically estimated investment functions. The functions developed in this study are no exception. The joint association of aggregate demand and the investment rate is apparent in Chart C which presents a scattergram of the investment rate plotted against the utilization rate.

The strong effect of a long period of weak demand upon investment rates is brought on by the comparison of the growth rates of aggregate output in the capital stock. As was indicated earlier in Chapter II, in an economy growing along a balanced growth path, the capital stock and output would grow at about the same rate. A rough idea of the cost of the depression is obtained by comparing the growth rate of capital with the growth rate of potential output. In the 1926-37 period, the private non-farm gross capital stock grew at a rate of 1.5% per year, less than one half the rate of growth of private non-farm potential output and about half the rate of growth of total potential output.

We shall consequently make explicit allowance for the effects upon capital formation, both in the analysis of the full-employment growth path of the past and in the estimation of the effects of the maintenance of full employment upon future growth. The values of investment selected for the alternative future projections to be presented below are indicated in Chart VI-1. The full-employment investment rate specified for the B projection will be used in the next section in developing a full-employment growth path over the period of the 1930's.

Chart VI-1

INVESTMENT RATE AND UTILIZATION RATE



B. FULL-EMPLOYMENT AND UNDER-EMPLOYMENT GROWTH PATHS

As was defined in Chapter II, an economy is moving along an equilibrium growth path when output and capital are growing steadily at the same rate. There are a variety of such paths, corresponding to different realized savings and investment rates. Starting at any arbitrary point in time, the full employment growth path is not necessarily an equilibrium growth path, because:

(a) The economy may not have been on the equilibrium path to begin with, and

(b) The rate of growth of the labour supply and technical change may not proceed at steady rates.

However, it is possible to use the model developed in Chapter II to derive a full employment growth path that would have been obtained in the past. This requires the specification of full employment growth paths of the supply of labour, capital formation and technical changes in the PNF sector, and of outputs in the other three sectors.

We have constructed a hypothetical full employment path over the 1930-39 period to examine the effect of the great depression upon capital formation and potential output. This full employement path is constructed on the basis of the following assumptions:

1. Technical chenge and the growth of potential labour supply in the PNF sector proceed at the observed rates.

2. Output and employment in the agricultural and government sectors are exogenous.

3. Business fixed investment each year is 14.5% of potential GNP, and the whole of the excess of estimated full employment capital formation over actual capital formation is allocated to the PNF sector.

4. Residential rents rise at the same rates as potential GNP. Since residential construction is not included in business fixed investment, this involves some implicit assumptions about the rate of residential construction.

The results of this analysis are presented in Table VI-2, together with comparisons of actual potential output. The hypothetical full employment potential, estimated potential, and actual potential GNP realized are plotted in Chart VI-2 for the 1930-39 period.

These results demonstrate that the retardation of capital formation brought about by the great depression had a substantial effect on the growth of potential GNP over the nine-year period. Between 1930 and 1939, the growth of potential output achieved was 2.90%. Had capital formation proceeded at full employment rates or full employment GNP, the growth of potential GNP is estimated to be 3.73%. As a result of this higher growth rate, potential GNP at the end of the 1930's would have been almost 8% higher than the level achieved.

It is clear from the assumptions listed above that we are here making allowance for only one of the possible ways the great depression affected potential output. On the basis of the findings of Chapter III, it is quite likely that the labour supply would have grown at a more rapid rate had full employment been maintained. Furthermore, the pace of technical advance and the outmovement of labour from agriculture may well have been delayed by the great depression. Consequently, the difference between the estimated potential

TABLE VI-2

ESTIMATION OF HIGH LEVEL EMPLOYMENT PATH
OF POTENTIAL GNP FOR THE 1930's

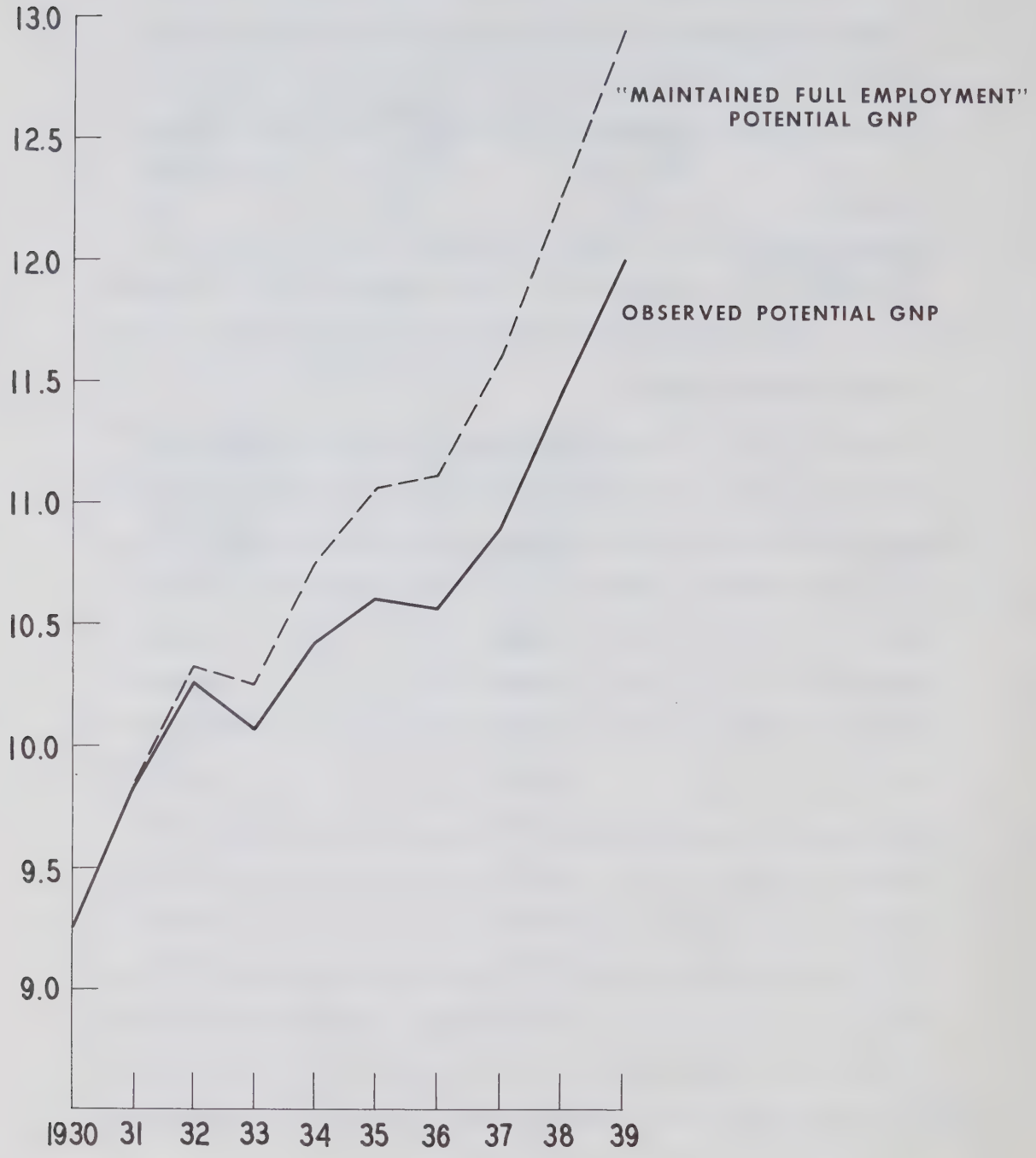
A. Growth Rates, 1930-39

	Potential GNP	Potential PNF Output	PNF Capital Stock
Observed	2.90	2.82	0.27
Estimated under full employment conditions	3.73	3.90	3.70

B. Paths of Potential Output

Year	Observed Potential GNP (Millions of Constant (1949) Dollars)	Potential GNP if Full Employment Were Maintained Throughout Period
1930	9,249	9,249
1931	9,826	9,836
1932	10,258	10,330
1933	10,062	10,250
1934	10,424	10,742
1935	10,603	11,057
1936	10,559	11,114
1937	10,887	11,594
1938	11,464	12,273
1939	12,003	12,937

Chart VI-2
GROWTH PATHS OF OBSERVED POTENTIAL GNP AND "MAINTAINED FULL EMPLOYMENT" POTENTIAL GNP
Billions of Constant 1949 Dollars



and hypothetical full employment potential paths, as large as they are, provide a conservative indication of the effects of the depression upon economic growth.

C. FUTURE PROSPECTS

In the preceding sections the role played by the different sources of economic growth in the past was examined, and the importance for economic growth of the maintenance of aggregate demand documented. While those findings are suggestive, it would be unwise to stop without examining the growth prospects of the Canadian economy over the next five or ten years. This procedure will shed additional light on the issue of policy for economic growth in two ways.

First, the growth prospects in the future will differ from the performance of past because the labour force is expected to grow particularly rapidly over the next few years, and because we will be unlikely to repeat the extremely poor average cyclical performance of the 1926-63 period. This is important because the concern over given increases in the growth rate will likely be less when the growth rate is high rather than low, and consequently ought to be taken into account when policies inimical to growth but desirable on other grounds are being evaluated.

Secondly, the alternative projections provide rough estimates of the effects of different policies upon the rate of growth of potential GNP. Two kinds of policies are evaluated:

(a) improved stabilization policy, and

(b) a successful policy of raising the investment and savings rate at full employment.

An examination of the growth gain from improved stabilization alone will be a useful supplement to the previous findings, for the projections will incorporate the effect of increased employment on the growth of potential labour supply, as well as upon capital formation. In addition, the projections are designed to show the effects of moderate changes in the average degree of utilization of the factors of production upon medium-term growth, starting from the estimated value of potential output in 1963.

Estimating the growth effect of raising the average investment rate to a level only slightly below that achieved in 1957 (the year of highest investment in the postwar period) would provide some guide to the possible growth impact of policies designed to favour savings and investment or of tax reforms designed to improve the allocation of savings between alternative investment uses. Because Canada already plows back a substantial portion of GNP into business fixed investment, it would likely be difficult, and possibly inconsistent with other economic and social objectives, to achieve an average investment rate much higher than this. 6/

Before we discuss the results it would be useful to discuss the underlying methods used. The B projection involves estimating the growth rate that would be realized if the economy achieved full employment and if the investment rate were similar to that achieved in full employment years in the past. The labour force projection is that published by Denton, Kasahara and Ostry, which is based upon full employment assumptions. 7/ Average weekly hours are assumed to decline 0.4% per year, a rate somewhat slower than that of the past. Finally, it is assumed that full employment was achieved in 1964 and maintained every year thereafter. On the basis of these assumptions, estimates of the capital stock and total output are developed for each year in succession.

The A, or unemployment, projection assumes that output would rise to 95% of potential in 1964 and would remain in that relationship to potential thereafter. An investment rate typical of that achieved in the post-1957 period is assumed. Net immigration is projected at a rate of 25,000 persons per year lower than in the first projection, and average weekly hours are assumed to decline at a slightly more rapid rate of 0.5% per year.

Finally, the C projection is based upon assumptions made in the B projection—that is, the full employment projection—except that the investment rate is raised to 16% of GNP, a rate surpassed in only two years in the 1926 to 1963 period.

Before we proceed to discuss the findings, some provisos are in order. The projections are not forecasts. Rather, they provide a rough comparison of the future prospects with the past and make it possible to measure the effects of alternative policies on the growth rate. In addition, we must point out that these projections ignore several questions of importance. Since technical change within the private sector is projected at the historical rate, the effects of increased education and of strengthened demand upon technical advance have been taken into account. The projections assume investment rates, but not savings rates, and the growth rate of potential GNP will be affected by the proportion of savings supplied from abroad. 8/

So much for the provisos. Let us turn to the findings. The results of the projections are summarized in Table VI-3. For convenience, the potential and actual output projections are also plotted in Chart VI-3. The major findings can be summarized:

1. The growth prospects of the Canadian economy are more buoyant than a crude extrapolation of the past record would indicate. Even if the

TABLE VI-3

THE THREE POTENTIAL GNP PROJECTIONS

I. Projected Values 1970 and 1975

Projection	Potential GNP (Millions of (1949) Dollars)			Labour Force			Capital Stock PNF Sector (Millions of (1949) Dollars)		
	A	B	C	A	B	C	A	B	C
Year									
1970	44,091	45,550	46,107	8,043	8,127	8,127	77,362	83,629	87,449
1975	55,235	58,084	59,666	9,056	9,210	9,210	95,668	109,634	118,127

II. Growth Rates—1963-70

	A	B	C
Potential GNP	4.60	5.07	5.24
Labour force	2.53	2.68	2.68
Average weekly hours (PNF sector)	-0.50	-0.40	-0.40
Capital stock (PNF sector)	4.04	5.15	5.79

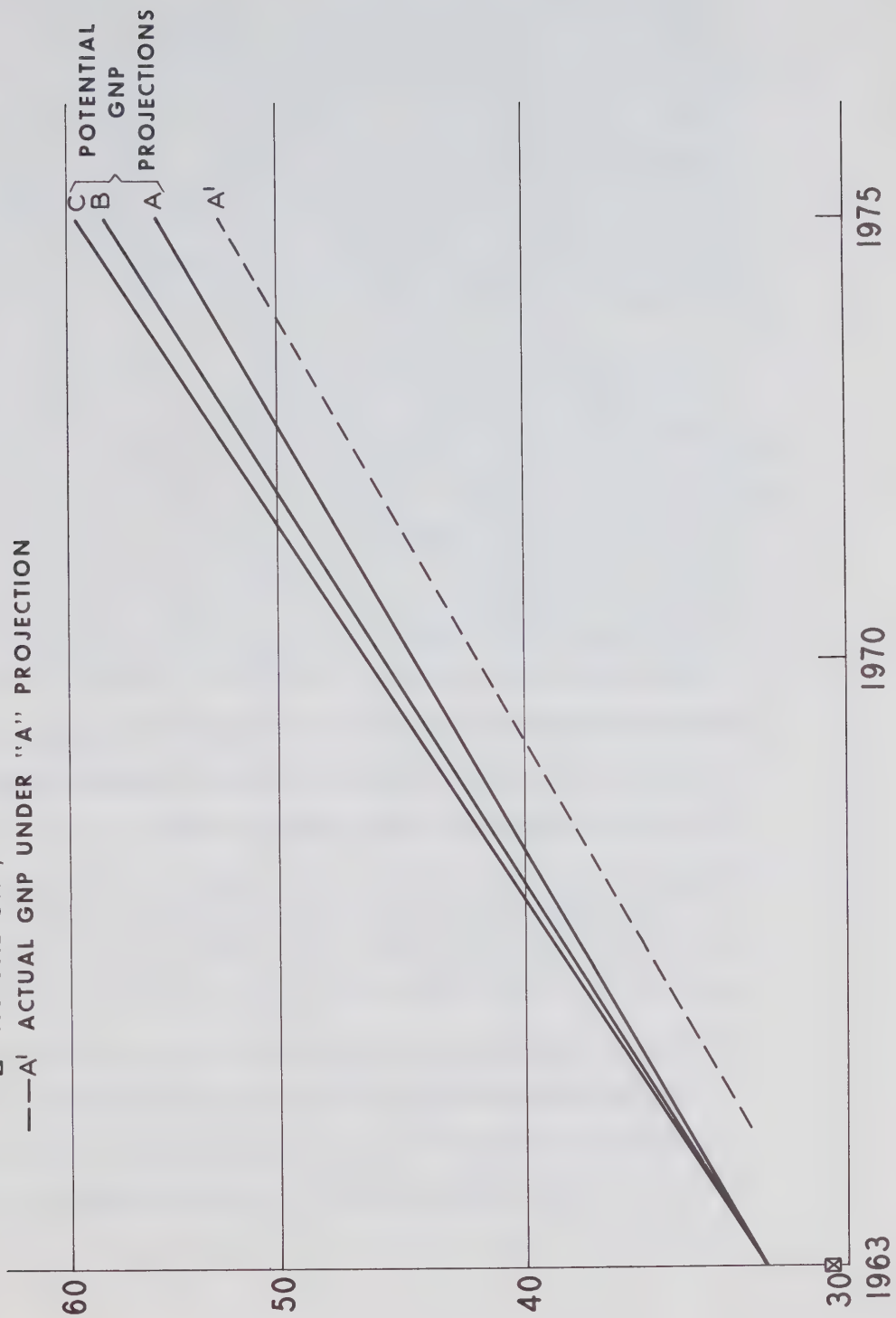
III. Growth Rates—1970-75

	A	B	C
Potential GNP	4.51	4.98	5.15
Labour force	2.37	2.50	2.50
Average weekly hours (PNF sector)	-0.50	-0.40	-0.40
Capital stock (PNF sector)	4.25	5.42	6.02

Chart VI-3

POTENTIAL GNP PROJECTIONS

Billions of 1949 Dollars



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the sluggish cyclical performance of the 1957-63 period is repeated, potential output growth over the next five to ten years will likely exceed that achieved in the past. This is due not only to the rapid growth of the labour force, but also to the effects of increased investment rates resulting from the avoidance of serious depression and major war. These two favourable effects were slightly offset by the reduction in the contribution to economic growth of the movement of the labour force from sector to sector that occurred in the past.

2. Achieving and maintaining full employment will have a substantial impact on the growth of aggregate potential GNP. Under full employment conditions potential GNP will rise at an annual rate four-tenths of a percentage point higher than under conditions of mild but persistent under-employment. Of this increase about 60% was due to increased capital formation, and about 40% to the increased growth of the labour supply resulting from increased immigration, reduced emigration, and the slower reduction of the work week. Since net immigration is higher, the increase in per capita GNP is slightly less, but is still somewhat above 0.3 percentage points.

3. Stepping up the investment rate to 16% of GNP will yield an additional 0.17 percentage points increase in the growth rate, indicating that the growth gain from improved stabilization policy is greater than the growth gain that might be expected from measures to achieve a 10% rise in the full investment rate. Conversely, a reduction in investment and savings to 13% of GNP would not, over the period of the projection, fully offset the growth gain from achieving and maintaining full employment. 9/

Table VI-4 presents estimates of the gain from the two kinds of policy, as measured by aggregate and per capita potential GNP in (1963 dollars) in 1970 and 1975. In addition, to contrast the relatively cost-less nature of the increased growth through stabilization policy with the cost (as measured by foregone consumption) of policies designed to permanently increase the capital formation rate at full employment, differences in aggregate and per capita public and private consumption are presented.

This table indicates the importance for future potential levels of income and consumption of maintaining full employment. While potential GNP is increased by a high investment policy, the payoff in terms of public and private consumption begins only after a considerable period has elapsed. In 1970, for example, total consumption is slightly lower under the high investment projection. By 1975, however, the high investment policy has yielded an increase in total consumption of $800 million (1963 dollars).

These projections indicate that the growth prospects of the Canadian economy are quite buoyant, provided that major recessions are avoided. Even under conditions of mild under-employment, the growth rate will be higher than the rate achieved over the 1926-63 period. The projected rate of 4.60% is 0.91 percentage points higher than the historical growth rate of gross domestic product. 10/ What accounts for this?

First, the labour force is projected to grow at 2.50% per year, whereas the historical rate was 1.65%. This alone would explain an increase of about .57 percentage points. The slower rate of decline projected for average hours worked in the PNF sector (0.50 vs. 0.54) would account for an additional 0.02 percentage points.

TABLE VI-4

PUBLIC AND PRIVATE CONSUMPTION 1/ IN 1970 AND 1975
UNDER ALTERNATIVE PROJECTIONS
(In millions of 1963 dollars)

A. Potential GNP

Projection Year	Total			Per Capita		
	A 2/	B	C	A	B	C
1963	57,819	57,819	57,819	3,060	3,060	3,060
1970	79,805	82,446	83,454	3,673	3,794	3,841
1975	99,975	105,132	107,995	4,160 3/	4,374 3/	4,494 3/

B. Public and Private Consumption 1/

Projection Year	Total			Per Capita		
	A 2/	B	C	A	B	C
1963	48,063	49,437	48,568	2,544	2,616	2,570
1970	66,339	70,493	70,101	3,075	3,244	3,226
1975	83,107	89,891	90,716	3,498 3/	3,740 3/	3,775 3/

Notes: 1/ "Public and Private Consumption" is GNP less producer's fixed investment. It, therefore, includes new residential construction and net inventory investment.

2/ The value of public and private consumption under the A projection is based upon actual GNP, which is 95% of potential GNP.

3/ The population estimates for 1970 for the B and C projections are taken from Denton, Kasahara and Ostry, op. cit., Table 1, p. 9. The 1975 population estimates for the B and C projections are obtained by projection from the 1970 estimate using the 1963-70 projected population growth rate. The population estimates for the A projection are adjusted to take into account the lower assumed rate of net immigration under conditions of under-employment.

Second, the historical rate of growth of the PNF capital stock of 3.03% reflects the retardation brought about by war and depression. The projected rate of 4.04% merely reflects the assumption that both events will be avoided. This would account for an increase of .32 percentage points of growth within the PNF sector, and 0.26 percentage points for the whole economy. The remaining small difference of 0.06 percentage points is explained by the higher projected growth of productivity in agriculture, offset in part by the lessened importance of inter-sectoral shifts of resources.

The assumptions on which these projections are based may turn out to be incorrect. However, it should be pointed out that several factors of potential favourable impact on economic growth—notably education and increased expenditures on research and development—are omitted. As was noted above, the data on education, in contrast to the case of the United States, suggest that education in Canada has not contributed much to economic growth in the past. As this reflects the lag in the rate of growth of the average level of education in Canada, in the future Canada can expect to reap the benefits of education that the United States obtained in the past.

The effects of increased expenditures on R and D are even more difficult to measure. Like investments in human capital, the exploration of the unknown is an activity that economic analysis is only beginning to come to grips with. While the measurement of the magnitude of the effect is impossible at this point, the direction of the effect on economic growth is clearly positive.

As for the differences between the high employment and moderate underemployment projections, this is also likely to be an understatement. As noted in Section A above, the maintenance of higher employment could

stimulate structural changes favourable to growth and could lead to a more rapid realization of economies of scale. These factors could easily account for an additional 0.15 percentage points of growth under higher level employment conditions.

REFERENCES

1/ In the equation used to test the assumption of constant returns to scale, the confidence interval for the economies of scale factor ranged from 0.43 to 1.16. This is a concrete illustration of how the collinearity between the passage of time and the growth of the factor inputs at the aggregate level precludes the precise estimation of economies of scale.

For the United States, Denison selected an estimate of 1.10 for the economies of scale factor. (Denison, op. cit., p. 175). The estimate of 1.15 used here is, therefore, likely to represent the maximum effect of economies of scale.

2/ Economic Council of Canada, First Annual Review, Ottawa: Queen's Printer, p. 38.

3/ See Section B, Chapter IV above.

4/ Schmookler, op. cit., Chapters VI and VII.

5/ In this discussion we assume that the rate of technical change under conditions of under-employment will be the same as that achieved in the past. The existence of economies of scale would have two offsetting effects on the rate of growth of total factor productivity in the future.

(a) To the extent that economies of scale are important, the faster rate of growth of the factors of production will result in a higher rate of growth of factor productivity.

(b) On the other hand, the greater size of the Canadian economy today relative to earlier years may mean that the appropriate economies of scale factor for the future is smaller than that of the past, hence tending to lower the rate of growth of total factor productivity.

6/ Some additional increase in the rate of growth of GNP could be achieved by measures to substitute national for foreign savings, but this would necessarily mean a further curtailment of current consumption. See also reference 9 below.

7/ F. T. Denton, Y. Kasahara and S. Ostry, Population and Labour Force Projections to 1970, Staff Study No. 1, Economic Council of Canada, December 1964, Table 2, p. 38.

8/ The method used is based on the implicit assumption that the proportion of investment financed from foreign sources of funds is the same for all three projections and is equal to the proportion of the existing capital stock financed from foreign sources of funds.

(continued)

8/ (continued)

We assume that the ratio of potential GNP to potential GDP for 1963 holds throughout the projection period for all three projections. This is a reasonable procedure if the proportion of investment financed from foreign sources remains stable. If the proportion of investment financed by national savings rose, the growth rate of GNP would be increased slightly.

9/ Note that a change of 1 1/2 percentage points in the investment rate is a change of 10% in gross investment. At a given level of utilization of potential, this is a substantial change in investment.

10/ Also the projected rate of 4.60% is 0.79 percentage points higher than the 1926-63 growth rate of potential GNP. The projected growth rates for GNP and GDP are the same. It is assumed that the 1926-63 decline in the ratio to GNP of dividend and interest payments to foreigners will not occur over the period of the projections.

CHAPTER VII: TAXATION AND ECONOMIC GROWTH

In this chapter we turn to an examination of the effects of taxation upon economic growth. We examine the effects of taxation in a full employment context, which has certain implications for the other economic policies of the government. To simplify the discussion, we assume that the level of federal government expenditures is given. This has the unfortunate effect of forcing us to look at the hole in the doughnut—namely, taxation—rather than the whole doughnut—taxation and expenditures. As many public expenditures contribute to economic growth, the reader should bear in mind that any bias against growth in the tax structure may be offset in part or more than offset by the growth generating effects of expenditures financed by the tax system.

A. AGGREGATIVE POLICY COMBINATIONS TO INCREASE THE POTENTIAL GROWTH RATE

Before we turn to an examination of the tax structure, which is the main task of this chapter, it is worth spelling out the implications of the full employment assumption for changes in aggregate levels of taxation and for their effect on the potential rate of growth.

A general increase in all taxes, given the level of government expenditures, would necessitate offsetting changes in other policies if full employment is to be maintained. If, on balance, the offsetting expansionary policies adopted stimulate investment, the combination of a tax increase with these policies represents a policy combination favourable to economic growth. In such a situation, the tax increase raises the national savings rate, and the offsetting policies stimulate investment or reduce private savings, or reduce

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the capital inflow. To the extent that the joint effect of the tax increase and the offsetting policies is to achieve a net increase in either national savings or domestic investment, the growth of potential GNP will be increased. 1/

The obvious policy which might be used to offset the contractionary effect of the tax increases is an expansionary monetary policy, which would both stimulate investment and reduce the capital inflow. Under a fixed exchange rate, an expansionary monetary policy relying solely on conventional tools—such as open market operations—would tend to reduce the surplus in the over-all balance of payments. Hence, the extent to which such a policy can be pursued is limited by balance-of-payments constraints. An expansionary open market policy supplemented by appropriate changes in debt management policy or by changes in secondary reserve requirements designed to affect the term structure of interest rates and the volume of bank lending relative to the money supply may perhaps be pursued somewhat further.

The existence of the balance-of-payments constraint under a fixed exchange rate suggests an alternative expansionary policy—devaluation. The combination of devaluation and a tax increase would raise the growth rate in two ways. First, the devaluation would reduce the capital inflow at a given level of domestic investment. This increases the growth of GNP via the substitution of government savings for foreign savings. Second, the reduction in the capital inflow must be accompanied by lower interest rates and temporarily by a more expansionary monetary policy. This would tend to raise domestic investment and hence the growth rate.

These two examples of offsetting policies indicate that, in an aggregative context, a tax increase may be part of a policy designed to raise the growth of potential GNP. While a tax increase alone would open a gap between actual and potential GNP and lower potential growth for the reasons discussed

in the previous chapter, a tax increase to raise the national savings rate coupled with appropriate policies to stimulate investment is a means to higher growth.

An increase in the growth rate so achieved is not costless. High taxes and devaluation reduce current consumption. Hence, the pursuit of economic growth via these aggregative policy combinations involves the sacrifice of consumption today in order to increase the growth rate and hence future potential levels of consumption.

We have already noted, in contrast, that the growth gain achieved via the simple maintenance of full employment is costless. 2/ Are there other sources of costless gains in economic growth? In particular, do appropriate changes in the tax structure present such opportunities?

An efficient tax structure is by definition one which cannot be modified to improve the achievement of one socio-economic objective without sacrificing some achievement of one or more other objectives. An inefficient tax structure, on the other hand, presents the opportunity for a better achievement of one or more objectives without sacrificing any other objective via appropriate revisions in the tax structure. Hence, this question is really a question of the policy efficiency of the existing tax structure.

B. THE TAX STRUCTURE AND ECONOMIC GROWTH

As was discussed in Chapter I, a tax system based heavily upon a progressive income tax has a built-in bias against economic growth, resulting from the zero taxation of leisure and the relatively heavy taxation of savings. This means that there may be an ultimate trade-off between

growth and vertical equity in a market economy. As was noted in that chapter, however, the existing tax system has a number of features which worsen the achievement of both horizontal and vertical equity on the one hand and growth on the other.

Hence, the present tax structure is inefficient in terms of these broad socio-economic objectives. It is possible, therefore, that the goal of economic growth need not be sacrificed, and may indeed be better achieved through the adoption of reforms designed primarily with a view to achieving horizontal and vertical equity. In addition, there may exist reforms which can further economic growth without sacrificing the achievement of equity or of other objectives. These include reforms designed to eliminate tax provisions which worsen the allocation of savings achieved by private markets, and reforms designed to correct for market distortions.

In the remainder of this chapter, we focus on the possible effects upon the growth rate of the major reforms discussed by the Royal Commission on Taxation. We then discuss efficient tax means of achieving an additional increase in the rate of economic growth in the event that the aggregative policy combinations discussed above are precluded by balance-of-payments and exchange rate constraints.

Unfortunately, the empirical work presented in the preceding chapters is at too aggregative a level to provide much of a guide for the effects of some of the reforms. The equations fitted are clearly more relevant for predicting the effects of changes in existing taxes than for assessing the implication of a far-reaching set of reforms. As a result, the tax reforms may cause a parameter shift in the estimated functions.

Furthermore, the tax reforms will not have either large revenue or aggregate demand effects. This means that the income effects of the reforms will be modest while their substitution effects may be great. However, substitution effects are more difficult to predict than are income effects.

This means that we cannot use the empirical findings of the earlier chapters to grind out a neat set of predictions of the effects of the reforms. However, the empirical results do provide some guidance as to which of the sources of economic growth are likely to be most affected by the reforms and do enable highly tentative estimates to be constructed for some of these effects. These findings are a slender reed but they, together with the revenue estimates presented in Volume 6 of the Report of the Royal Commission on Taxation, provide the empirical basis of the discussion.

The tax reforms will likely have only a modest influence upon the growth of the labour supply. The general lowering of the effective marginal rates of taxation on employment income would probably cause a moderate reduction in the rate of emigration, particularly among professional persons where the tax differential between Canada and the United States is quite large under the existing tax structure.

Whether the lower marginal rates will affect hours worked or effort more generally is difficult to determine. For individuals who earn the bulk of their income from employment, average as well as marginal rates of tax will be reduced. The income effect in favour of leisure may offset the substitution effect in favour of work. For individuals who have enough income from other sources, the reduced marginal tax rate on employment income may not involve a lowering of the average rate. In this case the substitution effect alone is operative and the tax reforms will, therefore, provide an inducement for greater effort.

The other aspect of the reforms which should be discussed is the changed treatment of income earned by wives. The aggregation of income of husbands and wives raises effective tax rates on wives' earnings for a wide variety of income classes. However, this is more than offset, for working mothers, by the special tax credits available to them. Only for persons in high income groups—where the decision of the wife to work is unlikely to be affected by tax rates—are the effective tax rates increased on working mothers. 3/ Consequently, it is doubtful whether these reforms will affect the over-all participation rate of females much one way or the other.

We conclude, therefore, that the effect of the reduction of marginal tax rates upon the income tax differential between Canadian and United States taxes on professional persons is sufficiently large that it will likely lead to some reduction in emigration. How large an effect cannot be predicted from the equations in Chapter III of this study, since the latter are relevant for the tax changes of the past, which were more evenly spread across all income classes. The influence of the tax reforms upon the other sources of growth of the labor supply would appear to be modest, although the general lowering of marginal rates could provide incentives for additional work.

It is unlikely that the tax reforms would have much effect on the rate of technical advance. The tax treatment of research and development expenditures would be unchanged. The tax treatment of expenses of post-secondary education would be more generous, and this should encourage more persons to avail themselves of opportunities for education. However, the resulting impact is difficult to determine, since it will depend in part on the growth and level of government expenditures for post-secondary education. In any case, the growth impact of any increase in education induced in part by the tax reforms would take a considerable period of time to be realized.

While the imposition of taxes on capital gains, taken by itself, would deter investment in ventures involving the application of new technology or the development of new products—both of which are sources of capital gains—this would be offset by the following features of the tax reform package:

1. The more generous loss offset provisions.

2. The reduction in the tax burden on income from equities brought about by integration.

3. The special capital cost allowance provisions for new enterprises.

These reforms will tend to raise the expected after-tax rate of return for a risky venture and will also make it easier to raise the funds required. Consequently it is unlikely that the reformed tax structure would deter investment in ventures designed to develop new products or new processes.

It would appear, therefore, that any major impact of the tax reforms upon the rate of growth would result from their effects upon capital formation. To an analysis of these we now turn.

C. THE TAX STRUCTURE AND CAPITAL FORMATION

In this section we discuss the effects of taxation upon capital formation. The discussion will focus upon investment decisions rather than savings decisions, since changes in national savings rates can be brought about readily by general tax increases. Furthermore, the stability of personal savings rates suggests that the effect of changes in the personal income tax structure upon this source of savings would be modest in any event. 4/ As for corporate savings, a discussion of the effect of taxation on corporate retentions will be incorporated in the analysis of taxation and investment.

Tax rates may impinge on the investment decision in two ways:

(a) Through their effect on the volume of corporate retentions.

(b) Through their effect on the marginal after-tax rate of return on investment.

The empirical results discussed in Chapter V indicate that both effects may be important.

Under the existing tax structure, either a corporate tax rate reduction or an increase in allowable capital consumption rates would provide a dual stimulus to investment by increasing corporate cash retentions and by increasing the marginal after-tax rate of return on investment. 5/

If one or more of these steps were taken under the existing tax structure, however, compensatory increases in other tax rates—such as sales tax rates or personal income tax rates—would be necessary under full employment conditions. 6/ Hence, there could be a conflict between the goals of growth and income redistribution if the available policy choices were so restricted. 7/

As is made clear in the opening chapters of their Report, the Royal Commission on Taxation chose to recommend far-reaching reforms of the over-all tax structure rather than simply changes in the tax mix within the existing tax structure. Because the Commission emphasized the goals of horizontal and vertical equity in designing the new tax structure, it is worth enquiring into the possible effects on the changes recommended upon investment decisions. As investment decisions by corporations account for the bulk of private fixed investment, assessing the impact of the tax reforms upon the tax burden on corporate source income is the first step in the analysis.

Effect of the Tax Reforms upon the Tax Burden on Corporate Source Income

Those reforms which have an important impact on the tax burden upon corporate source income include the following:

1. Integration.
2. Taxation of realized capital gains on shares in excess of retentions.
3. The abolition of the dual corporate rate.
4. The abolition of depletion and the three-year exemption for new mines.

In addition, the more liberal treatment of losses, the special capital cost allowance for new enterprises, and the general lowering of effective marginal rates of tax may have important effects.

There are several noteworthy aspects of the proposed change in the tax treatment of corporate source income. First, the net effect of the recommended tax changes upon corporate cash retentions is unlikely to be large. The estimates provided in Table 37-9 of Volume 6 of the Report of the Royal Commission on Taxation indicate that corporate gross retentions would rise by $10 million. This is small in relation to total gross corporate retentions which amounted to $4,472 million in 1964, 8/ (the year for which the revenue effects are measured). Below we have carried out our own analysis of the effects of integration upon the corporate retention policies of resident controlled firms. The estimates we obtained are roughly in accord with the estimates presented in the Report. As far as their impact upon corporate cash flow is concerned, the reforms are unlikely to provide much direct stimulus to either corporate savings or investment. 9/

Second, the burden of taxation would be shifted from marginal to intramarginal investments. The key revenue raising reforms at the corporate

level—abolition of the dual rate, abolition of depletion and abolition of the three-year exemption for new mines—would all bear more heavily upon intramarginal investments. The key revenue raising reforms at the personal level—the taxation of realized share gains—would have a similar effect, since the sources of such gains are intramarginal rather than marginal investments.

The key revenue losing reforms at the corporate level, on the other hand—the more liberal treatment of losses and the special capital cost allowance provisions for new enterprises—would tend to benefit marginal investments relatively more than intramarginal investments. While the tax benefit of integration depends in part on the existing payout ratio of the firm—being greater for firms with relatively high dividend payout ratios—the yield on marginal as well as intramarginal investments would benefit from this reform.

Finally, the relative burden of taxation upon different ventures and upon different industries would be radically altered. At present, certain kinds of investment are favoured and certain other kinds of investment are discriminated against by the tax structure. The tax reforms would eliminate both the favourable and the unfavourable discriminatory treatment; henceforth nearly all investments would be on the same footing. Exceptions would be made only for firms which are likely to be discriminated against in the capital markets,10/ and for research and development investments, which have significant external effects.

In addition, the over-all effect of these reforms would be to increase the over-all tax burden on corporate source income of non-residents, and to lower somewhat the tax burden on the corporate source income of residents.

Impact of the Tax Reforms upon
Corporate Gross Savings

The integration of the personal and corporate income taxes is the proposed reform with the greatest potential importance for firms' decisions to allocate earnings between retaining earnings and paying dividends. Since integration reduces the tax burden on corporate source income, we shall first discuss whether it will be shifted forward in price reductions and then examine the likely response of corporate retentions to integration at a given level of before-tax corporate profits.

In a companion study, Robert Lévesque has carried out a detailed inter-industry analysis of the extent to which corporate tax changes have been shifted in the past. 11/ He finds that the corporate tax was partially shifted forward in higher prices.

To what extent will the corporate tax changes recommended by the Royal Commission on Taxation be shifted? Unlike the tax changes analyzed by Lévesque, where United States and Canadian tax rates moved more or less in step, the enactment of the reforms recommended by the Commission would represent a set of independent Canadian tax changes. Moreover, with the exception of the removal of depletion and the three-year exemption for mines, the marginal tax rate applicable to investments by non-residents would be unchanged.

Under these circumstances, it is doubtful whether there would be any significant shifting of the various corporate tax changes. Whether an income tax can be shifted forward depends upon the following factors:

1. The state of competition within the industry.

2. The price elasticity of demand and the capital intensity of production.

3. The effect of the tax change upon the condition of entry of new firms into the industry.

4. The effect of tax change upon the demand conditions for domestically produced products.

The first factor will determine whether firms can attempt to shift the tax. Competition must be sufficiently restricted so that one or a small group of firms has the power to set prices. The second factor determines the extent to which it will be in the firm's interest to shift taxes forward. The lower the price elasticity of demand and the capital intensiveness of production, the greater will be the proportion of the tax change shifted forward. 12/

More important for our purposes are the last two factors. In an open economy with high seller concentration in many industries, the major constraints upon firms' pricing behaviour are the threat of entry of new firms on the one hand and the possible expansion of imports on the other. A tax change confined to Canada would not affect the latter constraint, whereas a simultaneous tax change in Canada and the United States might, since some forward shifting may occur in the United States.

As for the possibility of entry by new firms, an independent tax change in Canada will have less effect on the entry condition than would a simultaneous change of both United States and Canadian tax rates. In many lines of business, some significant potential entrants may be new foreign-controlled firms (including new subsidiaries of existing firms). A Canadian

tax change such as integration which does not affect the effective tax rate on subsidiaries of foreign firms will be unlikely to be shifted forward in these industries. 13/

In view of these considerations, it is apparent that the tax benefit of integration would unlikely be shifted forward via price reductions. However, Canadian consumers could benefit in the longer run as a result of any expansion of investment that occurred in response to integration.

We shall, therefore, examine the extent to which integration and the other reforms would affect corporate savings and investment on the assumption that no shifting of the tax changes would occur.

Assessing the effect of the over-all set of reforms upon corporate behaviour is extremely difficult, since many of the reforms work in opposite directions and since the impact of the reforms will vary greatly from firm to firm. The size of the firm, its existing dividend payout rate, the product it produces, and the degree of risk attached to its investment ventures will all affect the magnitude and the direction of the impact of the tax reforms upon its savings and investment behaviour.

The assessment of these reforms is further complicated by the fact that the average tax burden upon corporate source income levied at the level of the resident shareholder would be reduced, and the average tax burden levied at the corporate level increased. As this results largely from the integration of the two income taxes, a precise examination of the logical consequences of integration is the point of departure for the analysis.

Integration, when combined with the adoption of the comprehensive tax base, involves eliminating the present system of a separate corporate tax on corporate net income, an additional personal tax on dividend income, and a zero rate of tax on goodwill gains, and replacing it with a system which levies the same marginal rate of tax on retentions, dividends and goodwill gains.

This can logically be viewed as consisting of three distinct steps:

(a) Eliminating the existing personal tax on dividend distributions.

(b) Lowering the corporate tax rate to the relevant marginal personal rate of the shareholder.

(c) Instituting the taxation of goodwill gains at the marginal personal rate of the shareholder.

This three-way partitioning will facilitate the discussion of this complicated reform. The elimination of taxes on dividends and the imposition of taxes on goodwill capital gains are unlikely to have as significant an effect on corporate behaviour as the lowering of effective corporate tax rates.

Consequently, it is important to differentiate between those effects of integration which are roughly equivalent to corporate tax reductions and those which involve eliminating dividend taxes. This is done for resident corporations in Table VII-1.

As is apparent, taxes collected at the corporate level would rise because of the broadening of the base and the elimination of the dual rate. Once the lowering of the effective tax rate from 50% to the relevant marginal personal rate of the shareholder is taken into account, however, the "corporate" tax burden on corporate source income is reduced via the reforms.

TABLE VII-1

CHANGES IN THE CORPORATE TAX BURDEN ON CORPORATE INCOME (INCLUDING THAT EFFECT OF INTEGRATION WHICH IS EQUIVALENT TO A CORPORATE TAX REDUCTION)
(Millions of Dollars)

Item		Source	Mining, Oil and Gas	Manufacturing and Other	Total
1. Corporate Taxes, Current System	a) Total	36-1	164	1,769	1,933
	b) Non-resident	36-1	111	969	1,080
	c) Resident	(a)-(b)	53	800	853
2. Corporate Taxes, Reformed System	a) Total	36-1	317	2,079	2,396
	b) Non-resident	36-1	232	1,087	1,319
	c) Resident	(a)-(b)	85	992	1,077
3. Personal Taxes on Dividends, Current System		See Note 2	10	83	93
4. Revenue Loss due to Integration	a) Total	35-15	31	332	363
	b) Elimination of Dividend Taxes	See Note 3	8	68	76
	c) Remainder		23	264	287
5. Change in Tax Burden on Corporate Income		(2c)-(1c)-(4c)	+9	-72	-63

Notes: 1. Life Insurance companies are excluded from this and subsequent tables.

2. The total tax on dividends paid to residents by Canadian companies has been estimated on the basis of data reported in Taxation Statistics, 1966 Ed., Part I, Table 2. The total dividend credit reported for all taxpayers in each income class was multiplied by 5 to obtain estimates of dividends received from Canadian companies in each income class. Marginal personal tax rates for the average income in each income class (after allowing for the 20% dividend credit) were multiplied by total dividends to obtain estimates of dividend taxes (or rebates) by income class. Summing taxes less rebates across all income taxes yielded the estimate of $76 million used in the above table.

   This total was divided between Mining & Oil and Manufacturing & Other industries on the basis of dividends reported in Taxation Statistics, 1966, Part II, Table 4, and the resident ownership fractions reported in Appendix A, Note 21 of Volume 6 of the Report.

3. Revenue loss from integration was divided between the two groups of industries as follows:

   The total revenue loss was divided into that due to elimination of dividend tax and the remainder.

   The first was taken from line 7; the latter was divided between industries on the basis of the corporate taxes levied on residents in line 3c.

We now use these estimates to predict the effect of the tax changes on corporate savings and investment behaviour. In the next section we briefly discuss the effects of changing tax rates upon corporate source income at the personal level.

As noted in Chapter V, the dividend payout ratio has not been affected much by either changes in corporate tax rates on net income or by changes in the personal tax rate levied on dividends. If these empirical regularities continue to hold, and provided that firms regard integration as partly equivalent to a corporate tax rate reduction, the prediction of the effect of the reforms is straightforward, as illustrated in Table VII-2. As is apparent, under these assumptions the reforms would lead to a modest decrease in retentions in the resource industries and a modest increase in other industries. The estimated aggregate increase is only $25 million, which is small in relation to total corporate gross retentions.

As is shown in the last line of the table, the predicted small increase in corporate retentions is consistent with a more substantial increase in dividends (after personal income tax or rebate). Hence, it would be possible for management to increase retentions by a larger amount without their having to reduce the stockholders' current cash dividend income. Consequently, if the reforms stimulate an increase in investment, management could decide to raise retention rates as one means of raising the funds required. In that event, we would expect the estimated change in retentions to be more likely on the conservative than on the optimistic side. 14/

Impact of the Tax Reforms upon Corporate Investment

We now turn to an examination of the effects of the corporate

TABLE VII-2

EFFECT OF TAX REFORMS UPON CORPORATE RETENTIONS AND DIVIDENDS
OF RESIDENT-OWNED CORPORATIONS
(Millions of Dollars)

	Mining, Oil and Gas	Manufacturing and Other	Total
1. Corporate Taxes Attributable to Residents under Current System 1/	53	800	853
2. Corporate Taxes Attributable to Residents under Reformed System 1/	85	992	1,077
3. Revenue loss from Integration 3/			
a) Total	31	332	363
b) Due to elimination of dividend tax	10	83	93
c) Remainder	21	249	270
4. Change in Tax Burden (Excluding Dividend Taxes and Taxes on Goodwill Gains) 1/	+9	-72	-63
5. Change in Corporate Retentions (assuming a 60% payout rate) 2/	-4	+29	+45
6. Change in Dividends 3/			
a) Change in dividends paid by corporations	-28	-221	-249
b) Change in personal taxes	-31	-332	-363
c) Change in after-tax dividends	+3	+111	+114

Notes: 1/ Lines 1 through 4 are taken from Table VII-1.

2/ Line 5 is .4 times the reduction in the tax burden reported in line 4. The assumed long-run marginal payout ratio is based on the third equation in Table V-7 above.

3/ Line 6a is line 1 minus line 2 minus line 5.
Line 6b is minus the revenue loss from integrations reported in line 3a.
Line 6c is line 6a minus line 6b.

tax reforms, together with the effects of integration which are equivalent to a corporate tax rate reduction, upon the tax burden on corporate investment at the margin.

The first step is the estimation of the effective marginal tax rates under the current and reformed systems. As the tax base under the proposed system is a better estimator of corporate net income than is the current corporate tax base, we shall use the proposed tax base as the denominator.

To estimate the marginal tax rate under the existing system the numerator is simply corporate tax collections under the current system plus the estimated revenue gain from abolishing the dual rate. This latter adjustment is made on the grounds that for firms which decide upon the vast majority of investments, the existence of a low first bracket rate does not affect the relevant marginal tax rate.

Under the reformed system the numerator is estimated corporate tax collections less that portion of the revenue loss from integration which is equivalent to a corporate tax rate reduction.

The results of these calculations are presented in Table VII-3. They confirm the qualitative arguments presented earlier. In contrast to the modest effect upon corporate retentions, the reforms would have a more substantial effect on the tax rate relevant for investment decisions. The lowering of the marginal tax rates would result in an increase in the after-tax rates of return on corporate investments by resident controlled corporations of 24% in the non-resource industries. Because the after-tax rate of return in the resource industries would be reduced somewhat, the aggregate after-tax rate of return would rise by 21%.

If this increased rate of return is analyzed in terms of the investment functions developed in the companion study, 15/ the effect of the reforms upon corporate investment could be substantial. As is shown in Table VII-4, the investment of resident corporations could rise by as much as 14% after full adjustment to the reforms. In 1964 such an increase would have amounted to $316 million. This would amount to an aggregate increase of investment of about 4.5%, offset by some reduction in investments by non-residents in the resource industries. 16/ However, if interest rates rise as a consequence of the reforms, this would erode to some extent the stimulus provided by the increase in marginal rates of return.

This over-all increase of 4.5% would be equivalent to a larger increase in investment under the existing tax structure, however. The rationalization of the tax structure would concentrate the increase in ventures with the highest before-tax rates of return. In contrast, an increase in investment under the current tax structure would concentrate the increase in ventures with the highest after-tax rates of return under that tax structure. Consequently, a given increase in investment brought about via the tax reforms would make a somewhat larger contribution to economic growth than would an increase in investment brought about by other means under the existing tax structure.

How would such an increase in investment be financed? First, as noted above, management may choose to raise retention rates. In terms of the 1964 economy, an increase in retentions of $139 million would have been possible without eroding the after-tax current dividend income of stockholders as a group. Second, these corporate reforms, together with the elimination of the dividend tax, would eliminate the tax discrimination against the use of new equity issues. A modest increase in these issues could finance the remainder of the increase in investment. 17/

TABLE VII-3

EFFECT OF TAX REFORMS ON AFTER-TAX RATES OF RETURN AT THE MARGIN

Item	Source	Mining, Oil and Gas	Manufacturing and Other (excluding Life Insurance)	Total
		(Millions of Dollars)		
1. Corporate Tax Base (after reform)	36-1	632	4,160	4,792
2. Corporate Taxes, Current System				
a) Total	36-1	164	1,769	1,933
b) Non-resident	36-1	111	969	1,080
c) Resident	(a)-(b)	53	800	853
3. Corporate Taxes, Reformed System				
a) Total	36-1	317	2,079	2,396
b) Non-resident	36-1	232	1,087	1,319
c) Resident	(a)-(b)	85	992	1,077
4. Dual Rate Reform				
a) Total	(b)+(c)	—	255	255
b) Non-resident	37-3	—	81	81
c) Resident	37-3	—	174	174
5. Other Corporate Reforms				
a) Total	(b)+(c)	152	51	203
b) Non-resident	37-3	121	36	157
c) Resident	37-3	31	15	46
6. Estimated Corporate Tax Base After Reforms for Residents	$(1)x\frac{(3.c)}{(3.a)}$	169	1,985	2,154
7. Taxes on Dividends of Residents (Present System)	See Note 2 Table VII-1	8	68	76
8. Revenue Loss Due to Integration				
a) Total	Taken from	31	332	363
b) Due to abolition of dividend tax	35-15 See Note 3 Table VII-1	8	68	76
c) Remainder		23	264	287
9. Tax Burden on Typical Marginal Investment (Present System)				
a) Burden	(2.c)+(4.c)	53	974	1,027
b) Rate	(9.a)/(6)	.314	.491	.477
10. Tax Burden on Typical Marginal Investment (Reformed System)				
a) Burden	(3.c)-(8.c)	62	728	790
b) Rate	(10.a)/(6)	.367	.367	.367
11. Per Cent Change in After-Tax Rate of Return	$100\% \times \left[\frac{1.00-(10.b)}{1.00-(9.b)} - 1.00\right]$	-7.7%	+24.4%	+21.0%

TABLE VII-4

POSSIBLE INVESTMENT RESPONSE OF RESIDENT-OWNED CORPORATIONS

	Source	Total
1. Per Cent Change in After-Tax Rate of Return at the Margin	Table 7.3	21%
2. Estimated Elasticity of Investment with Respect to Changes in After-Tax Rate of Return	See Note 1	0.67
3. Total Capital Expenditure of Corporations (1964) (Millions of Dollars)	Taxation Statistics, 1966, Part II, Table 4	4,780
4. Estimated Capital Expenditures of Resident-Owned Corporations. (Millions of Dollars)	See Note 2	2,247
5. Estimated Change in Investment of Resident-Owned Corporations. (Millions of Dollars)	$\frac{(4)x(1)x(2)}{100}$	316
6. Total Producer's Fixed Investment (1964) (Millions of Dollars)	National Accounts 1965, Table 2	7,082
7. Change in Investment as a Percentage of Total Investment	100% x (5)/(6)	4.46%

Notes: 1/ This elasticity is the elasticity of investment with respect to changes in the rate of interest derived from the "best" equation estimated in the companion study by Wilson, op. cit.

2/ This is 47% of the total capital expenditures. This percentage is based on the percentage of total dividends received by residents as reported in the National Accounts.

The elimination of the dividend tax at the personal level is important in eliminating the tax discrimination against new equity issues. Whether the elimination of personal taxes on dividends would have any other significant effects on corporate behaviour is more doubtful, especially since the estimated revenue loss from eliminating taxes on dividends is less than the estimated revenue gains from the taxation of goodwill gains on shares. 18/

In the light of these estimated effects upon corporate savings and investment, it would appear that the tax reforms might provide a modest stimulus to aggregate demand. However, such a stimulus, if undesirable under the circumstances prevailing after enactment, could be readily offset by a modest general tax increase. 19/

D. EFFICIENT MEANS OF INCREASING THE GROWTH RATE

As demonstrated in Chapter VI, the maintenance of full employment would yield an extra dividend by increasing the growth rate of potential GNP. The enactment of the tax reforms recommended by the Royal Commission on Taxation would make a modest additional contribution to the growth rate via an improved allocation of savings between alternative investments and a probable modest increase in aggregate investment. To the extent that past experience may be used as a guide, the potential growth path achievable under these conditions would likely be somewhere above the B or full employment projection developed in the previous chapter, but would unlikely be as high as the C projection, unless the investment response is larger than we anticipate.

An additional increase in the growth rate over and above the rate achieved under full employment and a near neutral tax structure could be

achieved. The use of the appropriate mix of monetary, fiscal and exchange rate policies to achieve this goal has already been discussed. In addition, the tax structure itself could be altered to provide more stimulus to savings and investment.

Either of the means—changes in the tax structure or changes in the mix of aggregative policies—involves costs in terms of other socio-economic objectives. As increases in the rate of growth require an additional allocation of resources to investment in physical or human capital or in the development of new technology, such an increase in the growth rate would require a reduction in public and private consumption or an increased reliance on foreign savings.

If the use of the aggregative policy tools discussed earlier is precluded by balance-of-payments and exchange rate constraints, the tax structure may be altered to encourage savings and investment. The most efficient tax means for this purpose are savings and investment tax credits under the integrated income tax.

Introducing or increasing such credits would reduce the income redistribution achieved by the tax system, unless the necessary compensating tax increases were designed to increase the progressivity of the structure of income tax rates.

However, even in the event that the tax credits were compensated for by a general tax increase, the provision of savings and investment credits would involve less sacrifice of the goals of horizontal and vertical equity than would the enactment of tax provisions designed to favour designated industries, or the provision of a preferential tax treatment for capital gains, both of which would seriously erode the equity of the tax structure.

REFERENCES

1/ The maximum growth gain would occur if the rise in government savings were matched by an equal rise in domestic investment. If the rise in government savings were offset by a reduction in the net capital inflow, the growth gains would be more modest.

2/ If steady full employment growth involves a higher rate of inflation than the cyclical growth experience of the past, this would be a cost of achieving both full employment and the higher growth rate of potential GNP.

3/ If the husband's income is $15,000, for example, the effective tax rate on a wife's earnings of $3,500 is 22.7% under the present system. Under the reformed system the rate would be 26.2%, 23.9% and 20%, for wives without children, with school age children and with pre-achool children, respectively.

If the husband's income is $25,000, the effective tax rate on the wife's earnings would be 24.1% under the present law, and 34.4%, 32.1% and 28.7%, respectively, under the reformed system.

See Chapter 11 of Volume 3 of the Report of the Royal Commission on Taxation.

4/ An increase in the over-all level of personal income taxes would reduce personal savings.

The estimated reduction of $125 million in personal savings after the tax reform provided in Chapter 37 of the Report is based on rather conservative assumptions and represents the maximum reduction that might occur as a result of changes in the structure of personal income taxes.

5/ It is worth emphasizing once more that we are dealing with the effects of taxation in a full-employment context. This means that we can abstract from accelerator effects, since offsetting policy moves to control aggregate demand are implied.

6/ As noted at the beginning of the chapter, we assume that government expenditures are unchanged.

7/ Increases in high income bracket marginal tax rates would not raise sufficient revenue under the existing tax structure to be used to compensate adequately for corporate tax reductions.

8/ Source: National Accounts Income and Expenditures, 1965, Tables 50 and 51.

9/ As will be discussed below, however, the reforms would permit an expansion of retentions to finance any increase in investment without a reduction in the current cash dividend income (after personal tax) of shareholders.

10/ This is the rationale for the special capital cost allowance provision for new enterprises and for the expensing of exploration and development expenditures for mining and oil firms.

11/ Robert Lévesque, The Shifting of the Corporate Income Tax in the Short Run, a study published by the Commission.

12/ If capital intensity is low, only a small price change would be required to shift fully the corporate income tax.

13/ The average tax rate on foreign firms (outside the resource industries) would be increased very slightly by the reforms; the marginal rate of tax would be unchanged.

14/ In addition, these estimates made inadequate allowance for the effect of the special capital cost allowance provision for new small enterprises. It is estimated in Table 35-10 of Volume 6 of the Report that this reform would amount to a $400 million tax reduction spread over several years. The bulk of this tax reduction is likely to represent an addition to gross retentions, as well as to stimulate capital expenditures by these enterprises.

15/ Thomas A. Wilson, op.cit.

16/ How large a reduction in investment by non-resident owned firms in the resource industries would occur is difficult to determine in the absence of knowledge about the elasticity of investment with respect to the rate of return in those industries. Furthermore, the extent to which the increase in Canadian tax may be offset against taxes due to other jurisdictions is also important.

If the elasticity of investment in oil and mining with respect to the rate of return were the same as the aggregate estimate used in Table VII-4, and if more of the tax increase could be offset against taxes due to other jurisdictions, capital expenditures by non-resident controlled firms would be reduced by about $110 million.

17/ Debt financing could also be used. However, the tax reforms should lead to some reduction in optimal debt/equity ratios. Consequently, increases in equity—whether by retentions or by new issues—would likely finance the bulk of any increase in investment.

18/ The estimated revenue gained from taxing goodwill gains on shares is estimated at $155 million. (Appendix Table C-4, Volume 6 of the Report.)

19/ The estimated increase in the government surplus of $222 million (Table 35-1 of the Report) would appear to be sufficient. However, over the transitional period, the revenue yield of the system would be below its long-term yield.

CHAPTER VIII: OVERVIEW: SUSTAINED FULL-EMPLOYMENT GROWTH

The analysis of the previous chapters has concluded on an optimistic note. The growth prospects of the Canadian economy are buoyant, especially if a stabilization record better than that of the past decade is achieved.

There appear to be little grounds for fearing that the enactment of the tax reform package recommended by the Royal Commission on Taxation would slow the rate of growth. Indeed, our preliminary analysis suggests that the tax reforms would probably raise the potential growth path. Finally, if Canadians want to choose more economic growth and less current consumption or an increased dependence on foreign-controlled capital, various policy tools lie at hand. Either appropriate changes in the mix of fiscal, monetary and exchange rate policies or the adoption of tax credits to stimulate investment offset by general tax increases to provide savings could be used to raise the full-employment growth rate.

In this chapter we examine whether a higher rate of growth may itself tend to create balance-of-payments difficulties or worsen maladjustments between industries and regions. Following a comparison of the projections discussed earlier with those developed in previous studies, we discuss whether higher growth rates are viable in a market economy over the length of period used for the projections.

A. GROWTH AND THE BALANCE OF PAYMENTS

The possibility of a conflict between increased economic growth and the maintenance of balance-of-payments equilibrium was examined by the Economic Council of Canada in its First Annual Review. 1/ After developing projections

which indicated that the growth potential over the next few years is greater than that of the past, the Council expressed concern lest this higher growth rate lead to a worsened current account and a concomitant greater need for foreign capital in future years.

While those responsible for fiscal and monetary policy in Canada should and do keep a watchful eye on the balance-of-payments position, we believe that the realization of the higher growth rates projected by the Council and by ourselves would not of itself create additional difficulties in this respect.

To make this point clear, it is necessary to emphasize once more that we are discussing the effect of achieving a higher potential growth rate. Increases in the utilization of potential will tend to worsen the current account since imports will respond to the rise in income and exports will not. 2/

A rise in potential GNP given the level of utilization, on the other hand, will tend to stimulate both exports and imports. A rise in potential GNP is brought about by an increase in the supply of the factors of production or by increases in their productivity. Either source of potential growth would provide a stimulus to exports, since additional resources would be made available to export industries. In other words, the supply functions in the export sector would shift, thereby stimulating exports.

Similarly, the supply function of industries producing import substitutes would also shift, thus mitigating the effect of the increase in potential output on imports. This means that the long-run effect of sustained economic growth upon imports cannot be based on the short-run relationship

between imports and income. In the short run the income elasticity of imports is high; in the long run it is near unity. 3/

We therefore see little ground for the argument that a higher rate of potential growth would necessarily cause a worsening of the current account of the balance of payments in relation to full-employment GNP.

However, if the investment rate at full employment is increased, this will tend to worsen the current account at a given level of utilization. The (direct and indirect) import content of domestic investment is higher than the import content of alternative final expenditures. A shift toward investment will, therefore, lead to an increase in imports and a worsened volume of trade.

For example, if the gross investment rate at full employment were raised by 1.5 percentage points (or by about 10%) and consumption reduced accordingly, the fraction of GNP accounted for by imports would rise by 0.15 percentage points. 4/ At the level of current dollar GNP realized in 1965, this would mean an increase in imports of about $80 million, which may be compared to a trade deficit on income and product account in that year of $1.1 billion. This is a modest effect. 5/ Furthermore, it will tend to disappear over time as the cost reducing benefits of the higher investment rate are achieved.

We therefore conclude that, in contrast to the effects of cyclical changes in income, changes in the potential growth rate are unlikely to have serious consequences for the balance of trade.

The effects of a higher growth rate upon the capital account will depend on any changes in rates of return on real capital and in interest rates induced by the increase in the growth rate. The effects of the higher growth rates on real rate of return are examined in a different context in Section D. below. At this point it suffices to point out that any capital account effects can be readily offset by moderate adjustments in monetary policy.

We therefore conclude that the achievement of the growth rates higher than those achieved in the past would not, in itself, have adverse balance-of-payments effects. If steady full-employment growth led to greater inflation than that which accompanies growth with fluctuations, then the balance of trade would, of course, be affected adversely.

B. GROWTH AND STRUCTURAL UNEMPLOYMENT

This section discusses whether the achievement of higher growth resulting from the increased growth of the labour force and the maintenance of full employment would exacerbate the problem of structural unemployment, and whether the pursuit of economic growth via a high investment policy would have such an effect.

It is generally conceded that the maintenance of full employment is complementary with specific policies designed to reduce structural unemployment. A tight labour market in expanding regions provides an incentive for workers to move to these regions. When skilled labour is hard to get, firms have an incentive to train workers to fill their needs, and workers have an incentive to make the effort to acquire these skills. But what about an increase in the potential growth rate itself—would an

increase in the rate of growth of the labour force or an increase in the investment rate at full employment aggravate the problem of structural unemployment?

Structural unemployment is rooted in the relative imbalance of supply and demand in specific labour markets at a given level of over-all unemployment. Its existence increases the rate of inflation that is associated with a given level of unemployment. Attempts to reduce unemployment via aggregative policies will lead to an increased rate of inflation resulting from excess demand in those sectors with a tight labour supply. 6/

If an increase in the rate of growth of the labour force is brought about by an increase in immigration, structural unemployment will likely be reduced. Immigrants are unattached to particular regions, and will tend to head toward the regions with the strongest demand for labour. 7/ This will ease the pressure of demand in those regions at a given over-all level of unemployment, thereby permitting either a reduction in aggregate unemployment or a lowering of the rate of inflation.

Similarly, young persons are relatively mobile between regions and industries, are typically better educated, and have not yet acquired skills specific to particular occupations. Consequently, an increase in the growth of the labour supply brought about by a more rapid influx of young persons into the labour force should facilitate the growth of employment in expanding industries and regions, thereby causing a reduction in structural unemployment. Offsetting this to some extent will be an increase in frictional unemployment, since new entrants to the labour force typically experience some period of unemployment before they find their first job.

A sudden increase in the rate of capital formation at full employment could create bottlenecks in the capital goods producing industries, thereby giving rise to excess sectoral demand inflation. 8/ A more gradual increase in the investment rate, accompanied by an expansion of capacity in the capital goods producing industries, would avoid this problem.

The increase in labour productivity gradually brought about by the higher rate of capital formation should mitigate rather than worsen the conflict between unemployment and price stability. The available empirical evidence suggests that changes in money wage are not affected by the rate of change of labour productivity. 9/ Consequently, an increased rate of growth of labour productivity is consistent with a lower rate of inflation of the general price level at a given level of unemployment.

Furthermore, the increased capital formation would presumably be concentrated in the expanding sectors of the economy. It would, therefore, permit a more rapid growth of output in those sectors, thereby helping to alleviate sectoral bottlenecks.

We therefore conclude that higher potential growth rates—whether achieved by an expansion of the growth of the labour force or by an increase in the full-employment investment rate would more likely alleviate rather than worsen the problem of structural unemployment and the related problem of excess sectoral demand inflation, provided that any increase in the investment rate is achieved gradually rather than suddenly.

C. COMPARISONS WITH EARLIER STUDIES

In this section we shall compare the projections developed in this study with the recent projections made by Brown, and Drabble, as well as with the earlier work of Hood and Scott and Caves and Holton. After a discussion

of the differences between the output projections, we shall briefly contrast the method we have used with those used by these other writers.

Table VIII-1 presents a comparison of the growth rates of potential output, potential employment, average hours worked and the capital stock for the three alternative projections discussed in Chapter VI with comparable rates derived from data published in the studies of Caves and Holton, Hood and Scott, Brown, and Drabble. 10/

The salient feature of this table is the relative optimism of the projections we have developed. Our projected full-employment growth rate is about one half a percentage point higher than the typical estimates of the other writers. Even our projection of potential GNP under conditions of under-employment is at a rate slightly above the projection of others, except for the higher of the Hood and Scott projections.

In order to determine whether these differences be explained by differences in projected rates of growth of the labour supply, Table VIII-2 presents a comparison of the differences between the average output projections of others and our under-employment and full-employment projections, together with estimated differences after allowance is made for differences in the projections of the labour supply. It is clear that the relative optimism of the B projection is not wholly accounted for by differences in projected growth rates for employment and hours worked.

It follows, therefore, that the differences between our full-employment projection and those of others reflect differences in projected growth rates of labour productivity. In contrast, the more moderate differences between our under-employment projection and the projection of others are largely explained by the differential projected growth rates for the labour supply.

TABLE VIII-1

PROJECTED GROWTH RATES OF GNP:
A COMPARISON OF THE PRESENT AND PREVIOUS STUDIES

	Present Study (1963-70)			Hood-Scott* (1965-70)		Brown** (1966-71)		Drabble**	Caves-Holton*** (1955-70)		
	A	B	C	2.5% basis	3.25% basis	Proj. 1	Proj. 2	(1963-70	Low	Mean	High
Potential Output	4.60	5.07	5.24	4.12	4.75	4.46	4.57	4.57	3.22	3.81	4.40
Potential Employment	2.50	2.65	2.65	2.34	2.34	2.41	2.41	2.68		1.75+	
Average Weekly Hours	-0.50	-0.40	-0.40	-0.53	-0.53	-0.67	-0.67	-0.45		NA	
Capital Stock	4.04	5.15	5.79	4.53	5.14	NA	NA	NA		NA	
	(1970-75)			(1970-75)		(1971-76)					
Potential Output	4.51	4.98	5.15	3.75	4.40	4.33	4.40				
Potential Employment	2.37	2.50	2.50	2.23	2.23	2.28	2.28				
Average Weekly Hours	-0.50	-0.40	-0.40	-0.75	-0.75	-0.73	-0.67				
Capital Stock	4.25	5.42	6.02	4.14	4.80	NA	NA				

Notes: * The Hood-Scott projections used are those based on net annual immigration of 50,000 persons, as are the B and C Projections in this study and the projections of potential GNP made by Drabble.

** Brown also projected future output under alternative policy conditions using an econometric model. As these projections involve departures from full employment, and as estimates of potential GNP under the projected conditions are not presented, these projections are not included in this table.

*** As Caves-Holton present estimates only for the single year 1970, it is not possible to derive estimated growth rates for shorter projection periods.

+ This is based on the labour force projection for 1970 of 7.230 million persons made by Caves-Holton (op. cit., p. 286) and the 1955 Labour Force estimates of 5,558,000 for 1955 published in National Accounts Income and Expenditure, 1926-56, Table II of Appendix.

Sources: W.C.Hood and A.D. Scott, Output, Labour and Capital in the Canadian Economy, Royal Commission on Canada's Economic Prospects, 1957, Ch. 5, Appendix A.

T. M. Brown, Canadian Economic Growth, Royal Commission on Health Services, 1964, pp. 118-21, 132-37.

B. J. Drabble, Potential Output, 1946-1970, Economic Council of Canada, Staff Study No. 2, 1964, Tables 23, 28, 31, pp. 54, 59, 62.

R. Caves and R. Holton, The Canadian Economy, Table 39, p. 302.

TABLE VIII-2

DIFFERENCES BETWEEN PROJECTED GROWTH RATES, 1963-70 *

		Hood-Scott** 1965-70	Brown** 1966-71	Drabble 1963-70
A.	A (Under-employment) Projection of Potential Growth Minus Alternatives			
	Observed difference	.165	.085	.13
	Difference after allowance is made for differences in projected growth of the labour supply **	.035	-.08	.22
B.	B (Full-Employment) Projection of Potential Growth Minus Alternatives			
	Observed difference	.635	.555	.60
	Difference after allowance is made for differences in projected growth of the labour supply ***	.40	.205	.59

Notes: * The Caves-Holton projection is omitted in this table because they did not project average weekly hours and because the projection periods are not comparable.

** Average of projections presented in Table VIII-1.

*** This line is obtained as follows:

Adjusted Difference = Observed Difference in Projected Output Growth Rate - .685 (Difference in projected employment growth Rate + Difference in projected growth rates of average hours worked).

The adjustment coefficient of .685 is the estimated relative share of income received by labour in the PNF sector.

This suggests the explanation for the relative optimism of our high employment projection. The techniques used by the other writers involved projections of past trends of productivity growth. As we have demonstrated at several points in this study, historical rates of growth of productivity will understate the rate that could be achieved if full employment were maintained. Because our under-employment projection is more in line with historical experience, the differences between it and the projection of others are more modest. The full-employment projection differs from the projections made by others for precisely the same reason it differs from the under-employment projection—in it is incorporated an explicit allowance for the faster growth of the capital stock that would occur under conditions of maintained full employment. In the light of this explanation, and with the knowledge that no allowance was made for the effect of the maintenance of full employment upon the rate of growth of total factor productivity, we believe the B projection is as likely to understate as to overstate the potential growth that could be realized under conditions of maintained full employment.

There are three main differences between the projection techniques used in this paper and the techniques used in the other studies cited. First, while the projections developed in those studies are assumed to be full-employment or high level employment projections, nothing is assumed about the path of actual output over the projection period. In contrast, this issue is given central importance in the projections we have developed.

Second, the other writers projected productivity trends and capital stock trends exogenously. 11/ In our projections the capital stock is generated sequentially on the basis of explicit assumptions about investment rates and utilization rates. The feedback of aggregate demand upon the growth of the

capital stock and hence upon the growth of labour productivity is thereby taken into account.

Third, the high, mean and low projections in the earlier studies reflect alternative assumptions about productivity and labour force growth. In contrast, the high or C projection in this paper is explicitly designed to measure the impact of a high investment rate upon the growth of potential GNP.

In summary, capital formation, the growth of the labour supply and the growth of labour productivity are treated as partially endogenous in our projections, in the sense that they are related to aggregate demand and to full-employment investment rates. In the earlier studies, the connections between the projected growth rates and economic behaviour during the projection period were not made explicit.

It is worth comparing the projections of Caves and Holton and Hood and Scott for the period 1955-65 with the observed growth of actual GNP to determine whether the best estimates of these two pairs of writers are on the conservative or on the optimistic side.

The relevant comparisons are presented in Table VIII-3. As is apparent, the actual growth of the economy over the 1955-65 12/ period exceeded the "best" projection of Caves and Holton by one half of one percentage point, and was one quarter of a percentage point above the average of the Hood and Scott projected rates. In fact, despite the under-utilization experienced in the 1957-64 period, the growth rate achieved was only slightly below the rate for the "high" projection of Caves and Holton.

The understatement of these projections in the past is, of course, no

TABLE VIII-3

GROWTH RATES* OF GNP: ACTUAL, HOOD AND SCOTT PROJECTIONS AND CAVES AND HOLTON PROJECTIONS

A.	Actual GNP 1955-65 Growth Rate	4.32%		
		Low	Mean	High
B.	Hood and Scott*** Projected Growth Rates 1955-65 **	3.55%	4.05%	4.51%
		Low	Mean	High
C.	Caves and Holton Projected Growth Rates 1955-70 **	3.22%	3.81%	4.40%

Notes:

* As elsewhere in this study, all growth rates referred to are continuous exponential growth rates.

** The Hood and Scott and Caves and Holton projected growth rates are based upon observed GNP in 1955, and may therefore differ from growth rate calculations made by these writers on the basis of the data available at the time. No adjustment for under-employment was made to either 1955 or 1965 GNP. As both years were years of slight under-employment, the growth of actual GNP should be a close estimate of the growth of potential GNP.

*** The three Hood and Scott projections are as follows:

"Low" - based on net immigration of 50,000 and productivity growth rate of 2.5% per year.

"Mean" - average of high and low productivity projection for net immigration of 75,000.

"High" - based on net immigration of 100,000 and productivity growth rate of 3.25% per year.

Source: a) Actual GNP figures, National Accounts Income and Expenditure, D.B.S., Table 5 (1926-56), p. 36, Table 56 (1965), p. 56.

b) W.C.Hood and A.D. Scott, Output, Labour and Capital in the Canadian Economy, Royal Commission on Canada's Economic Prospects, 1957, Table 5.20, p. 226.

c) R. Caves and R. Holton, The Canadian Economy, Harvard University Press, 1959, Table 39, p. 302.

guarantee that our own projections do not overstate the potential growth rate in the future. 13/

D. THE EFFECT OF HIGHER GROWTH RATES UPON THE RATE OF RETURN ON CAPITAL

Are the potential growth paths in the B and C projections, which both involve departures from past experience with respect to average utilization and investment rates achieved, viable in an economy organized largely along private enterprise lines? The answer depends in part on whether the higher rates of capital accumulation would substantially erode the rate of return on capital.

It is a simple matter to derive the path of the over-all real rate of return from the estimated projections of output and the capital stock. Assuming that the relative income shares remain constant, the annual rate of change of the before-tax gross rate of return at full employment is simply the difference between the rate of growth of PNF potential output and the rate of growth of PNF capital stock. 14/

It is clear from Table VI-4 that the B or full-employment projection is consistent with a constant real rate of return. In the C projection, real rates of return would fall gently at a rate of 0.40% a year over the 12-year period. This would mean that real before-tax rates of return on capital at full employment in the PNF sector would decline from 12.9% in 1963 to 12.2% by 1975. 15/

Let us remember that we are referring here to rates of return at full employment. The achievement of full employment itself would tend to raise actual rates of return above the typical levels achieved in the past. This means, for example, that if the economy moved smoothly along the C projection

TABLE VIII-4

GROWTH RATES OF FULL-EMPLOYMENT RATE OF RETURN FOR POSTWAR PERIOD AND FOR ALTERNATIVE PROJECTIONS

	Growth Rate			Full-Employment Rate of Return End of Period **
	PNF Potential Output	PNF Capital Stock	Gross Rate of Return *	
1948-56	5.55	5.50	0.05	0.1281
1956-63	5.19	5.05	0.14	0.1293
A Projection				
1963-70	4.85	4.04	0.81	0.1355
1970-75	4.69	4.25	0.44	0.1385
B Projection				
1963-70	5.38	5.15	0.23	0.1300
1970-75	5.21	5.42	-0.21	0.1287
C Projection				
1963-70	5.57	5.79	-0.22	0.1261
1970-75	5.41	6.01	-0.60	0.1223

* Growth rate of PNF potential output minus growth rate of K (PNF capital stock).

** $\frac{(.315)\ (\text{Potential output})}{\text{PNF capital (K)}}$

we could expect higher average rates of return over the whole period than those achieved under the A or under-employment projection. Consequently, we have no reason on these grounds to doubt that growth paths higher than those achieved in the past are viable.

E. SUMMARY

The most significant finding of this study is the pervasive influence of aggregate demand upon the rate of growth of potential output. The importance of demand is documented in the statistical analyses of the growth of the labour force and the rate of capital formation. Its quantitative importance is revealed in the estimation of equilibrium and full-employment growth paths for the past, and in the projections of future growth under alternative aggregate demand assumptions. Evidently the achievement of prosperity augments the future supply of resources as it permits an expansion of current consumption and a reduction in unemployment.

To raise the full-employment growth rate once the benefits of prosperity have been recouped is a more difficult task, as many other writers have pointed out. A 10% rise in the full-employment investment rate would make a modest additional contribution to the rate of economic growth. In contrast to the gain from achieving and maintaining full employment, however, this gain is not achieved without cost, and the benefits in terms of future public and private consumption will be realized more gradually.

It is within this context that the tax reforms recommended by the Royal Commission on Taxation and alternative tax proposals should be evaluated. In contrast to variations in aggregate demand, changes in the tax structure are unlikely to have a significant effect upon the growth of potential GNP in either direction.

The particular set of proposals put forward by the Royal Commission on Taxation would appear on balance to stimulate rather than stifle economic growth. Improvements in allocative efficiency, a reduced stimulus to emigration, and a modest increase in the aggregate investment rate would appear to be in the cards if the proposed reforms were enacted, once firms and individuals had adapted to the new tax system. However, the stimulus so provided is likely to be modest, and could easily be wiped out in the short run by difficulties in the transition period.

The most important prerequisite for the realization of the buoyant growth prospects of the Canadian economy is a strong and steady rate of growth of aggregate demand. The enactment of the recommended reforms would probably provide a modest additional increase in potential growth and would certainly be compatible with an improved stabilization policy, which is and will remain the front line of growth policy.

REFERENCES

1/ Economic Council of Canada, First Annual Review, Chapter 5.

2/ Assuming that a devaluation of the exchange rate does not accompany the expansion. If the increased utilization leads to significant price inflation, this will tend to reduce exports as well as provide an additional stimulus to imports.

3/ See the companion study by Robinson. (T. R. Robinson, Foreign Trade and Economic Stability, a study published by the Royal Commission on Taxation.)

4/ This estimate is based on the direct and indirect import content of different final expenditures obtained from the updated input-output table prepared for the Commission by J. A. Sawyer.

5/ By way of contrast, the strong effect obtained by Rhomberg results from his use of an extremely high propensity to import from investment expenditure. The coefficient used was based upon a regression function in which the cyclical effects of investment changes would be of some importance. (R. R. Rhomberg, "Effects of Exchange Depreciation in Canada, 1960-64", in Conference on Stabilization Policies, Economic Council of Canada, Ottawa: Queen's Printer, 1966.)

6/ Lipsey has defined structural unemployment in relation to the trade-off between unemployment and inflation. (R. Lipsey, "Structural and Deficient-Demand Unemployment Reconsidered", in A. M. Ross (Ed.), Employment Policy and the Labour Market.

7/ Assuming that the immigrants are not concentrated in occupations with high unemployment.

8/ For a discussion of the different causes of inflation and a theoretical analysis of excess sectoral demand inflation, see Charles Schultze, Recent Inflation in the United States, Study Paper No. 1, Study of Employment, Growth and Price Levels, U.S. Joint Economic Committee, Washington, 1959.

9/ For analyses of Canadian data see G. L. Reuber, The Objectives of Monetary Policy, a working paper prepared for the Royal Commission on Banking and Finance, and the forthcoming study prepared for the Economic Council of Canada by G. L. Reuber, R. Bodkin, E. Bond and R. Robinson.

10/ See the notes to Table VIII-1 for a detailed statement of the derivation of the figures from the published work of these writers.

11/ As both 1955 and 1965 were years of moderate under-utilization, the growth of actual GNP should be a close estimate of the growth of potential GNP.

12/ See the Annual Report of the Governor of the Bank of Canada, 1966, pp. 37-38.

13/ One cannot discount the possibility that the observed slowdown in productivity growth in the last two years may be spurious. In the light of the major upward revision in the index of industrial production published in May 1966 (see the Annual Supplement to the Monthly Index of Industrial Production, D.B.S., May 1966), current output estimates, based upon extrapolative techniques beyond census benchmarks, could understate the true growth of output. In addition, major revisions in the other components of gross domestic product are currently under way.

14/ The projections of Brown and Drabble examined here do not include estimates of capital stock trends.

15/ The rates of return calculated in this table are not comparable to commonly published financial statistics. All property income before taxes, as well as depreciation, is included in the numerators, and total fixed capital, including capital financed by debt as well as by equity, gross of cumulated depreciation in the denominator. In addition, both numerator and denominator are expressed in constant (1949) dollars.

APPENDIX A

THE ESTIMATION OF POTENTIAL GNP (by R. G. Scott)

Introduction

The present study has examined the growth of the Canadian economy between 1926 and 1963 with the object of measuring the role played by the major productive factors. An important feature of this work has been the construction and use of measures indicating the level of output which the Canadian economy could have attained if available productive factors could have been kept fully employed. Because these potential output measures appear to be a useful tool in various kinds of economic analysis, a precise description of their derivation will be useful. The aim of this appendix is to acquaint the interested reader with the way in which the potential output estimates were derived and with the data sources used.

Two potential output series relating to the period 1926-63 have been developed:

1. Potential gross domestic product at factor cost valued in constant (1949) dollars for the private, non-farm sector, excluding residential rents (hereafter referred to as PNF).

2. Potential gross national product at market prices valued in constant (1949) dollars for the entire economy.

Both series were developed on an annual basis from 1926 to 1963 (excluding the World War II and immediate postwar years). The basis one is that of

gross domestic product at factor cost for the PNF sector and was derived from a production function fitted to annual output data of this sector for the period 1926-63. The potential gross national product at market prices series was obtained directly from the PNF series by:

(a) Adding back the constant (1949) dollar value of those items deducted from the deflated value of gross domestic product in order to arrive at PNF output to obtain potential GDP at factor cost.

(b) Multiplying gross national product by the ratio of potential GDP to actual GDP.

The concept of potential output used here is not that of the technological maximum output which the economy is capable of producing. Following Knowles, it is viewed rather as:

> ...the amount the economy could produce at some stipulated rate of use of the labour force and of capital, and under the assumption that productive resources are used at something approaching the economy's notion of a least-cost combination of inputs...without excess strain or breakdown, on the one hand, or on the other, excessive, wasteful slack in the system, particularly prolonged, involuntary unemployment of labour. 1/

As such, it corresponds to full employment output in the sense that output cannot be increased without imposing undue pressure on the general price level.

Availability of potential output data provides a basis for measuring the extent to which actual output has fallen short of or has exceeded the full employment norm. A measure widely used is that of the full employment "gap" (namely, the difference between potential and actual output) expressed as a percentage of potential output, which is included in Table II-1 above. This gap provides some indication of the extent to which aggregate demand

exceeded or fell short of full employment output for the Canadian economy as a whole during the period under review.

The Model

Underlying the concept of potential output is some kind of functional relationship between available factor inputs and the output which they can produce. The full employment level of potential output clearly depends upon the supply of factor inputs, the state of technology, and the composition of demand. Actual output differs from this level mainly as a result of cyclical variations in output. A production function was, therefore, fitted to the observed data on output, labour input and the capital stock with specific allowance being made for the effects of the business cycle on output by the introduction of a cyclical variable. Given available factor inputs, potential full employment output can be derived directly from the parameters of the production function by setting the cyclical variable at its full employment value.

Before the production function could be fitted, it was necessary to specify the form it might reasonably be expected to take. A simplifying assumption, but one frequently made in highly aggregate models, is that output is a function of two inputs, namely, labour and capital, and the level of technology, itself a function of time:

$$P = f(At, Lp, K)$$

where P = potential output in a specified period

A(t) = level of technology (including all trend factors tending to change the level of potential output over time)

Lp = potential labour input

K = potential capital input

Other assumptions, specifically incorporated into the model, are as follows:

(1) No mix effect

The amount of labour and capital required to produce each type of good or service depends upon technological factors and, in general, each product embodies different combinations of the two inputs. As the composition of demand alters, the output obtained from given quantities of labour and capital will change if there are shifts in the aggregate toward goods and services requiring either more labour or capital, or less of either or both. The assumption that there has been no such "mix" effect implies, therefore, that changes in the composition of demand during the period under review have not significantly affected the level of output. Two of the major shifts taking place in the Canadian economy which have likely affected the level of output are the decline in the relative importance of agriculture and the enlarged share of government in the gross national product. In order to make allowance for the changed relative importance of these broad sectors, the production function was estimated for the private, non-farm sector alone.

(2) Neutral technical change

That is, technical change, in the aggregate, has not affected the marginal rate of substitution of capital for labour.

(3) Technical change is disembodied at the margin

(4) Constant returns to scale

(5) Unit elasticity of substitution of capital for labour

(6) The percentage contribution to output of a 1% change in labour or capital is measured by its respective share in income.

As is described in the text of the study, 2/ several of these assumptions were tested statistically.

As a result of these assumptions, it was possible to adopt as a starting point the "classic form of the Cobb-Douglas production function, in which the exponents of labour and capital are equal to their respective shares in income:

$$P = A(t)Lp^{1-\alpha}K^{\alpha}$$

Provided that factors are combined efficiently and full use is made of known technology, potential output (P) can be regarded as the sum of

(i) actual output, as observed, and

(ii) the additional output (which may be negative in inflationary periods) resulting from the utilization of all productive factors at their full employment norm.

Thus, in order to derive potential output from a production function fitted to actual output, allowance must be made for departures from full employment capacity utilization. Present data on capacity utilization is deficient, however, and the only satisfactory alternative is to use a variant of the unemployment rate to indicate changes in the degree of resource utilization. 3/ Accordingly, the Cobb-Douglas form of production function was modified by a cyclical variable representing the ratio of actual labour input to potential labour input:

$$Q = P\left(\frac{La}{Lp}\right)^{\gamma} = A(t)\, Lp^{1-\alpha}\, K^{\alpha}\left(\frac{La}{Lp}\right)^{\gamma}$$

where Q is the observed actual output. The exponent γ of the cyclical variable (La/Lp) measures the elasticity of output with respect to changes in the degree of labour utilization and is assumed to be constant. 4/

Both sides of the production function were then divided by Lp and it was assumed that the level of technological progress increases exponentially. Thus

$$q = e^{bt} k^{\alpha} u^{\gamma}$$

where $q = Q/Lp$

$k = K/Lp$

$u = La/Lp$

In this form, the production function expresses the relationship between productivity per unit of potential labour input on the one hand and the state of technology, capital deepening and the degree of labour utilization, on the other. The exponent per capital, α, represents the share of capital in income and is assumed to be constant. The equation is linear in logs and estimates of the technological progress parameter and the exponent of the cyclical variable may be found by means of simple least squares regression procedures.

An aggregate production function is an heroic simplication. Ideally, an extremely disaggregated production model should be estimated. In order to increase the validity of the results from an aggregate production function, the more striking sources of non-homogeneity were eliminated by:

(i) excluding the product of agriculture, government and residential rents from both sides of the production function, 5/

(ii) omitting the years during and immediately following World War II (1940-46). 6/

The equation from which the potential output series has been derived is fitted using data relating to the PNF sector of the Canadian economy for

the period 1926-63. 7/ The relevant equation (with t values in parentheses) is

$$\text{Lnq} - 0.315\,\text{Lnk} = -.5233 + \underset{(19.83)}{.0197t} + \underset{(17.59)}{1.7160\text{Lnu}} \qquad R^2 = .98$$

At potential full employment operating levels, Lnu = 0 since La = Lp. Potential PNF output may therefore be derived by using the following transformation:

$$P = \text{Antilog}\left[(-.5233 + .0197t + .315\,\text{Lnk})\right].(\text{Lp})$$

Derivation of the Potential Output Series

Estimates of potential PNF output in constant (1949) dollars were obtained directly from the foregoing transformation.

The potential GNP series is calculated on the assumption that the percentage gap at full employment relevant to total output on a national product basis is identical to that when output is measured on a domestic product basis. The difference between these two national accounts aggregates, represented by the residual error of estimate and the net flow abroad of dividends and interest, is relatively small and the GNP gap would not be affected significantly if these items were treated as autonomous instead, that is, independent of both actual and potential output. It is first necessary to obtain a potential series for total GDP at factor cost by treating the difference between the actual value of total GDP at factor cost and PNF output as autonomous output and adding it back to the potential PNF output data. Finally, potential GNP at market prices is derived from the following formula:

$$\text{Potential GNP at MP(t)} : \text{Actual GNP at MP(t)} \times \frac{\text{Potential GDP at FC(t)}}{\text{Actual GDP at FC(t)}}$$

The GNP full employment gap (the reciprocal of the ratio of potential to actual GNP at market prices) has also been calculated and is shown alongside the potential GNP series.

Measurement of the Production Function Variables

(1) Output

Although the difference between GDP and GNP is relatively small when both are valued at market prices, an output measure on a domestic base is to be preferred as the dependent variable in a production function, variations in which are to be explained by reference to the productive factors available for employment. Since the analysis is conducted in real terms, constant dollar data are a prerequisite but there is a choice whether to use gross or net output. Output measures, which are gross of depreciation and other capital cost allowances, are not only less complicated to handle than net output data but are also likely to be more reliable from a conceptual point of view, since the rate of economic capital consumption is extremely difficult to measure and may bear little relation to the accounting magnitudes incorporated into the National Accounts, which are sensitive to changes in the tax treatment of capital consumption allowances. For these reasons, a gross output measure, valued in constant (1949) dollars, was used as the dependent variable in the production function. For the reasons previously discussed, the production function was fitted to the private, non-farm sector. Because of the unsatisfactory nature of available residential housing stock data, residential rents were excluded from output for the private, non-farm sector.

It was desired to obtain measures that are consistent with the National Accounts. Total gross domestic product at factor cost in constant (1949)

dollars was estimated by multiplying GDP in the base year by an output index based on real gross national expenditure less net interest and dividends paid to foreigners and residual errors of estimate.

The alternative procedure of using the published GDP indexes would have involved difficulties of reconciliation with the National Accounts; furthermore, these indexes are not available prior to 1935. Constant (1949) dollar estimates of GDP originating in agriculture, GDP originating in public administration and defence and imputed rents to government buildings, and residential rents are then deducted from the constant dollar GDP series to obtain PNF output.

(a) GDP originating in agriculture

Estimates of constant dollar output data for the agricultural sector from 1935 to 1963 are based upon the published indexes of real domestic product for that sector. The GDP index for agriculture is simply scaled up by the constant factor 15.95, obtained by multiplying the weight given to agriculture in the real output indexes (.10714) by total GDP at factor cost in 1949 ($14,885 million) and dividing by 100.

Independent estimates of GDP originating in agriculture are derived for the period 1926-35 by making use of the data contained in Part II of the D.B.S. publication "Handbook of Agricultural Statistics". Total gross agricultural income is deflated by the wholesale price index for Canadian farm products (1935-39 = 100). Then the total operating expenses of farmers (excluding depreciation), deflated by the price index of commodities and services used by farmers which is on the same base as the wholesale price index, are deducted. Finally, the resulting constant dollar GDP estimates are converted from a 1935-39 base to constant (1949) dollars and linked at 1935 to the series obtained from the real output index.

(b) Public administration and defence

Public administration and defence has a weight of 4.666 in the index or real domestic product (1949 = 100). Following the procedure adopted in agriculture, the individual index for this industrial category is multiplied by the constant factor 6.945 to obtain constant (1949) dollar estimates of GDP originating in public administration and defence. 8/

It is difficult to arrive at a market value for a large part of the GDP originating in public administration and defence. These GDP estimates are therefore based on salaries, wages and supplementary labour income. In order to obtain estimates of real output in public administration and defence for the period 1926-35, the current dollar value of GDP originating in public administration and defence is deflated by an index of government wages (1935-39 = 100) supplied by D.B.S. The resulting series is converted to a 1949 base and linked at 1935 to the constant (1949) dollar series obtained from the index of real domestic product.

(c) Residential rents

A current dollar total for residential rents is obtained by adding gross rents paid by tenants (National Accounts, Table 47, line 12) to net imputed residential rent and imputed residential capital assumption allowances (National Accounts, Table 47, line 14). The former data include payments in respect of expenses (taxes, insurance, etc.), which are not included in the gross rents imputed to owner-occupants, but it was not possible to obtain separate estimates of these amounts and no allowance is made for them. The total of gross residential rents is then deflated by an implicit price index (1949 = 1) obtained by taking the ratio of the current dollar value of total personal expenditures on shelter (National Accounts,

Table 47, line 11) to the corresponding constant (1949) dollar value (National Accounts, Table 58, line 4).

(2) Capital Stock

Data on capital stocks for the private, non-farm, non-residential rent sector were kindly made available by T. K. Rymes who was in the course of preparing capital stock estimates for publication by D.B.S. 9/ The estimates used are on a gross basis and are valued in constant (1949) dollars. They have been computed at the industry and sub-industry level by aggregating deflated investment data relating to building construction, engineering construction, and purchases of machinery and equipment over specified periods representing the respective assumed lives of plant and equipment. 10/

The coefficient of the capital variable is assumed to be constant and its value was chosen by reference to the observed share of capital in output during the period under review. No attempt has been made at this stage to estimate the value of the capital coefficient directly from a fitted production function because it is anticipated that the high degree of multicollinearity between capital and time will give rise to nonsensical results. In order to arrive at the share of capital, an estimate of income accruing in the PNF sector is made and reconciled with current dollar estimates of GDP at factor cost for the PNF sector. This total income is allocated between labour and capital as follows:

Labour Income

Total wages, salaries and supplementary labour income, less that portion accruing in agriculture and public administration and defence (National Accounts, Table 22)

\+ Two-thirds of the net income of non-farm unincorporated business (National Accounts, Table 1)

Income of Capital

Total investment income less investment income earned in agriculture (National Accounts, Table 23)

- Imputed gross rent on government-owned buildings (National Accounts, Table 49) and gross residential rents paid by or imputed to persons (National Accounts, Table 47) 11/

+ One-third of the net income of non-farm unincorporated business (National Accounts, Table 1)

+ Capital consumption allowances and miscellaneous valuation adjustments of corporations (National Accounts, Table 51) adjusted to exclude depreciation of agricultural property 12/

+ Inventory valuation adjustment (National Accounts, Table 1).

The allocation of non-farm unincorporated business income to labour (two-thirds) and capital (one-third) is arbitrary and merely reflects the approximate relative shares of labour and capital in total output. The shares of labour and capital in PNF output are remarkably constant over time, the relative shares in recent years being much the same as those prevailing in the late 1920's. However, the relative shares do vary cyclically: the share of capital fell significantly during the deep depression of the 1930's, rose above its "normal" or long-term level during the war years, and has since fluctuated moderately around the long-term level. Equations are fitted using the actual share of capital and the average of actual capital shares for the years 1926-30 and 1950-63, thus omitting those years of abnormal economic conditions. There is little to choose between these equations but those using the average share (0.315) are selected because the deviations from the average appear to reflect mainly short-run cyclical variations.

(3) Labour Input

The contribution of labour to production is affected not only by employment but also by the number of hours worked. Measurement of labour

input should, therefore, take both of these variables into account and labour inputs have, in fact, been calculated as the product of employment and average hours worked per year. Two distinct measures have been drawn up, namely, potential labour input or the total man-hours available for productive purposes (whether actually employed or not) and actual labour input derived from published employment and hours worked data. In both cases, employment in agriculture and public administration and defence is specifically excluded from the calculations but, because of deficiences in the basic data, it is not possible to derive estimates of either potential or actual hours which relate solely to the PNF sector. Moreover, it should be noted that, although gross rents paid by or imputed to persons are not included in PNF output, no adjustment has been made to labour input in respect of employment in the finance, insurance and real estate industries.

The potential labour input data measures the secular trend of the labour force and hours of work. The series of actual labour input is required in order to construct a cyclical variable which could be incorporated into the production function to offset the influence of the business cycle on the underlying long-run production relationships. As discussed earlier, this cyclical variable is specified to be the ratio of actual to potential labour input.

(a) Actual labour input

(i) Employment

In order to arrive at PNF employment, an estimate of government employment was deducted from total non-agricultural employment given in the National Accounts (Appendix, Table II). Hood and Scott have estimated government employment for the years 1926-55 and their figures appear to

be the only authoritative long-run data available. 13/ However, it was necessary to deduct post office employment from the Hood and Scott estimates as postal services are included with the output of the transportation, storage and communication industries.

As GDP at factor cost originating in public administration and defence is based on the deflated value of labour costs, it should move in line with actual employment. A scatter diagram of real GDP at factor costs originating in public administration and defence on Hood and Scott's government employment estimates (adjusted to include armed forces personnel and to exclude post office workers) indicates an extremely close correlation between the two series for the period 1926-55 with the exception of the war years. The adjusted Hood and Scott series is, therefore, carried forward to 1963 by linking it at 1955 to the real output index for public administration and defence and then deducting the number of armed forces personnel. 14/

(ii) Hours worked

Data on hours worked is scanty but M. C. Urquhart kindly permitted the use of the recently compiled historical statistics prior to publication. 15/ It should be noted that the available data is characterized by a substantial fall in actual hours worked between 1941-46. This decline is difficult to explain in view of the unusually heavy demands made on the economy at that time and the movement of average hours in the United States. The data presented by Knowles on hours, for example, increased throughout the war years until 1944 and then declined sharply.

An index of average hours worked per week for the commercial non-agricultural economy (1949 = 100) is available for the period 1949-62. 16/ After careful examination of various source data on average hours worked,

it was decided to link the series of average hours worked by persons with jobs in non-agriculture contained in the "Historical Series for Canada" to the aforementioned index. An estimate of average hours worked in 1963 was made by reference to other published data. The link was made at 1950 to avoid an unexpectedly large movement in the index between 1940 and 1950, representing a reduction in average hours worked of about 2.4%, which puzzled the preparers of the index:

> This was the largest single year to year change of the entire period and seemed to warrant further investigation. The various techniques and adjustments used in the development of the underlying average hours worked series were again scrutinized for conceptual suitability, statistical consistency and arithmetic accuracy, but the root cause of this particularly large decrease from 1949 to 1950 appears to rest with the basic data themselves. 17/

Although a decline of 3.0% is apparent in the historical series between 1950 and 1951, other source data fail to reveal a sharp drop in hours worked at this time. These include Hood and Scott's series for the Business Economy, 18/ the D.B.S. data on hours in manufacturing, 19/, a composite series using employment weights for average hours worked in mining, manufacturing and construction, 20/ and a series making use of the annual census of manufacturing industries. 21/ Each of these series had been examined earlier but were rejected in favour of the more comprehensive series contained in the recently published D.B.S. productivity study.

(b) Potential labour input

(i) Employment

The potential employment series is drawn up on the basis of the following three assumptions:

> That participation rates of the population in the labour force are not affected by employment levels.

That unemployment has been confined to the PNF sector.

That 4% of the PNF labour force is unemployed when the PNF sector is operating at potential output levels.

The first two assumptions are necessary because of the method used to estimate government employment and the paucity of information for the years prior to 1946 about participation rates by age-sex groups and about the extent of unemployment among agricultural workers. As a result of these assumptions, potential employment was taken to be 96% of the following aggregate:

Total civilian labour force

- Agricultural employment

- Government employment.

The third assumption is roughly equivalent to selecting an aggregate unemployment rate of 3.5%. As is discussed in Chapter 2 of the Report of the Royal Commission on Taxation, the unemployment rate selected should reflect the relative importance attached to the goals of avoiding inflation and reducing unemployment. 22/ On the basis of the available empirical evidence, an unemployment rate of 3.5% is consistent with a mild rate of inflation of the GNP deflator of 1.5% to 2% per year, provided that sectoral demand bottlenecks and cost push pressures are avoided.

(ii) Potential weekly hours

It is abundantly evident that the standard work week has fallen dramatically since the mid-1920's but there is no adequate data relating to the economy as a whole. Moreover, available data on the standard work week is quite fragmentary and it has not been possible to use it to construct an over-all measure. Derivation of a potential weekly hours series, therefore,

proved to be somewhat arbitrary as recourse had to be made to trends observed in the series of actual hours worked.

Hours worked appear to have been falling moderately prior to World War II, although the underlying trend is to a large extent masked by the impact of the depression. The sharp reduction in the average number of hours worked per week which had been achieved by 1946 in both Canada and the United States suggests that the trend toward a shorter work week had accelerated during the war years. Weekly hours have continued to decline in the postwar period but at a noticeably slower rate.

Knowles found the representation of similar trends in the United States quite troublesome and, after attempting unsuccessfully to fit several functional forms, decided to make various short-term linear interpolations. 23/ In the case of the Canadian data, the figure for average weekly hours worked in 1928 is used as the potential level for the period 1926-28. Potential hours for the period 1929 to 1946 were obtained by fitting two point-to-point exponential curves to the actual hours data for 1928, 1938 and 1946. For the final period, potential hours are obtained by fitting a least squares regression equation in logarithmic form to the actual hours series with time and the logarithm of the employment rate as the independent variables. The following regression equation (with t values in brackets) is obtained.

$$\ln AWH = 3.7753 - \underset{(9.95)}{0.0042}\ t + \underset{(1.49)}{0.1710}\ \ln \text{Emp. Rate.}$$

$$\bar{R}^2 = 0.97,\ SEE = 0.0043,\ DW = 1.55$$

The potential hours series is then obtained from this equation with the employment rate set at 0.96 (in accordance with the assumption of a 4% unemployment rate at potential output) in the above-mentioned equation. 24/

(4) Time Trend

The time trend variable, A(t), was introduced to allow for the effects of technological progress, improvements in the quality of inputs, and other factors varying with time which could not be explicitly taken into account in specifying the form of the production function. It is assumed to be exponential in form and its regression coefficient, therefore, indicates the compound growth rate of what may conveniently be called technical change.

The procedure used here assumes that technical change is, in fact, smooth and exponential. An alternative procedure analogous to that used by Solow would be to assume that the estimated residual from the production function picks up the effects of technical change as well. However, as the residual will be affected by errors of measurement and by misspecification of the cyclical adjustment mechanism, this approach did not appear attractive. Some checks on the reliability of the potential GNP series are presented in Appendix B.

At an earlier stage, a preliminary set of estimates were derived which differed slightly from the estimates developed here. These preliminary estimates were used by various members of the Commission's staff in their analytical work. Consequently, the re-estimation of any functions that were published in any other study papers using the series presented here will in general lead to somewhat different results.

The difference between the preliminary and final series reflected three factors:

(a) The final series were based on output data estimated from the revised

National Accounts published in the 1964 National Accounts, whereas the earlier series were based on output data published in the 1963 National Accounts.

(b) The earlier potential series were derived from a production function fitted to all the years in the 1926-63 period, but with a dummy variable included in the function to identify the war years. The revised series were derived from a production function fitted to all years except the war years.

(c) The method used to derive the PNF output series from the National Accounts data and to adjust for indirect taxes were different.

The differences between the preliminary and final potential GNP estimates and the difference between the preliminary and final estimated percentage gaps were small—with the exception of the last couple of years which reflected the revision of the National Accounts data.

REFERENCES

1/ James W. Knowles, "The Potential Economic Growth in the United States", Study Paper No. 20, Study of Employment Growth and Price Levels for the Joint Economic Committee, Washington, 1960, pp. 7-8.

2/ See Chapter II of this study.

3/ Another proxy variable for the degree of utilization, namely, the ratio of output to its previous peak value, was tried as an alternative but the resulting regression equations are, in general, less satisfactory. However, the trend coefficient in these equations for technical change is not substantially different from that obtained when a variant of the unemployment rate was used.

4/ It is to be expected that $\gamma > 1$, since productivity in the short run tends to increase when the degree of utilization rises. Moreover, since studies of the cyclical behaviour of productivity have indicated that productivity increases are usually more pronounced in the early stages of an upswing, estimates of γ should be viewed as a measure of the average elasticity of output with respect to changes in the degree of labour utilization during the period under review.

5/ N. H. Lithwick has examined the importance of inter-sectoral shifts for the period 1937-61. Of the increase in productivity attributed to inter-sectoral movements of labour and capital, he found that 9.68% was due to the movement of these factors out of agriculture. See N. H. Lithwick, Economic Growth in Canada: A Quantitative Analysis, Harvard University doctoral thesis (unpublished) 1963. See also the discussion in Chapter II of this study.

6/ Knowles introduced a "mix factor" into his production function to allow for the effects of inter-sectoral shifts. This variable is particularly high during the war years; its effects might therefore have been incorporated almost as well by using a war dummy variable, or omitting the war years.

7/ Constant (1949) dollar values are used throughout; the years 1940-46 are omitted. Details of adjustments to published data, including deflation procedures, are to be found in a later section of this Appendix.

8/ The estimated figure for 1949 is $695 million whereas Table 21 of the National Accounts shows $740 million. The discrepancy appears to be due to the exclusion of the output of certain types of government employees (mainly construction workers) from the public administration and defence output index. No adjustment was made in respect of this discrepancy.

9/ The capital stocks for manufacturing industries have subsequently been published. See Fixed Capital Flows and Stock Manufacturing, D.B.S., 1966. See also Canadian Statistical Review, July 1964, for a progress report on the measurement of the stock of fixed capital by industry in Canada.

10/ The capital stock estimates used in Knowles' study were based on survival curves indicating the estimated percentages of original installations (in constant prices) surviving after given intervals; the survival curves were drawn up by Dr. George Terborgh using the results of an empirical case study on the assumption that mortality rates of capital equipment are constant. Similar data are not available for Canada.

11/ Total rents, whether paid or imputed, are allocated to the finance, insurance and real estate industries and must, therefore, be deducted from total investment income.

12/ Estimates of farm depreciation were obtained on a confidential basis from D.B.S.

13/ W. C. Hood and A. D. Scott, Output, Labour and Capital in the Canadian Economy, a study for the Royal Commission on Canada's Economic Prospects, p. 199.

14/ The Hood and Scott series appears low in relation to other estimates. Indeed, Hood and Scott have pointed out that they reluctantly scaled down their original figures to agree with census benchmark data, op. cit., p. 352. However, the rate of growth for the period 1952-63 of the government employment data based on the Hood and Scott estimates is not markedly different from those derived from other sources and the lower scale of the Hood and Scott estimates is not a drawback in the present analysis.

15/ M. C. Urquhart (ed.), Historical Statistics for Canada.

16/ "Indexes of Output per man and per man-hour in Canada's Commercial Non-Agricultural Economy 1949-1962", D.B.S., 1964 (circulated in draft form), p. 78. A preliminary version of this index was made available prior to publication of this document and was used in the regression analysis.

17/ Ibid., p. 14.

18/ W. C. Hood and A. D. Scott, op. cit., Appendix F.

19/ Canadian Statistical Review, Historical Summary 1963, Table 27.

20/ Loc. cit.

21/ General Review of the Manufacturing Industries of Canada, 1953, Table 31.

22/ Because the production function is fitted in logarithmic form, the actual figure chosen for the unemployment rate is not crucial as it affects only the constant (i.e., level of the equation) and not the regression coefficients.

23/ See J. W. Knowles, op. cit., pp. 52-53.

24/ In addition to this equation which uses the index of average hours worked per week for the commercial non-agricultural economy linked at 1950 to the series taken from the Historical Statistics for Canada, a second equation using a composite of several series as the dependent variable was fitted. More specifically, the dependent variable consisted of three series linked together at 1950 and 1960, namely, the Historical Statistics for Canada series (1946-50), a composite series using employment weights of hours worked by production and non-production workers in manufacturing as well as in the mining and construction industries (1950-60), and another composite series making use of average hours worked in total manufacturing, mining and construction (1960-62). The resulting regression equation was inferior on all counts to the one adopted.

APPENDIX B

ALTERNATIVE ESTIMATES OF POTENTIAL GNP IN THE POSTWAR PERIOD

Three simple tests of the reliability of the potential GNP series in the postwar period are presented in this appendix.

1. One would expect to find a fairly close relationship between the unemployment rate and the relative gap between actual and potential GNP (Potential minus Actual as a percentage of Potential). The simple correlation coefficient between the unemployment rate and the relative gap based on the potential GNP series developed in this study is .95. 1/ This coefficient is very highly statistically significant, and indicates that about 90% of the variation in the relative gap series is associated with variations in the unemployment rate.

2. As is clear in Chart 2-1 in Chapter II above, actual GNP exceeded potential GNP during the early postwar period. In the period 1958-63, on the other hand, the GNP gap did not close as rapidly as the unemployment gap. This behaviour might suggest that the technique used had yielded a biased estimate of the growth rate of potential GNP during the postwar period. We compared the potential GNP estimates developed in this study with a series based upon "Okun's Law", a simple procedure for estimating the output gap from the unemployment rate. 2/

We use the same adjustment coefficient of 3.2 used by Okun for the United States which is based on the assumption of a low elasticity of response of employment to changes in output.

The resulting series are plotted in Chart B-1. As can be seen, the estimates of potential output developed here are a somewhat smoother series than the series estimated from the unemployment rate. 3/ More important, however, the two series have a similar trend which suggests that little bias is introduced by the production function approach.

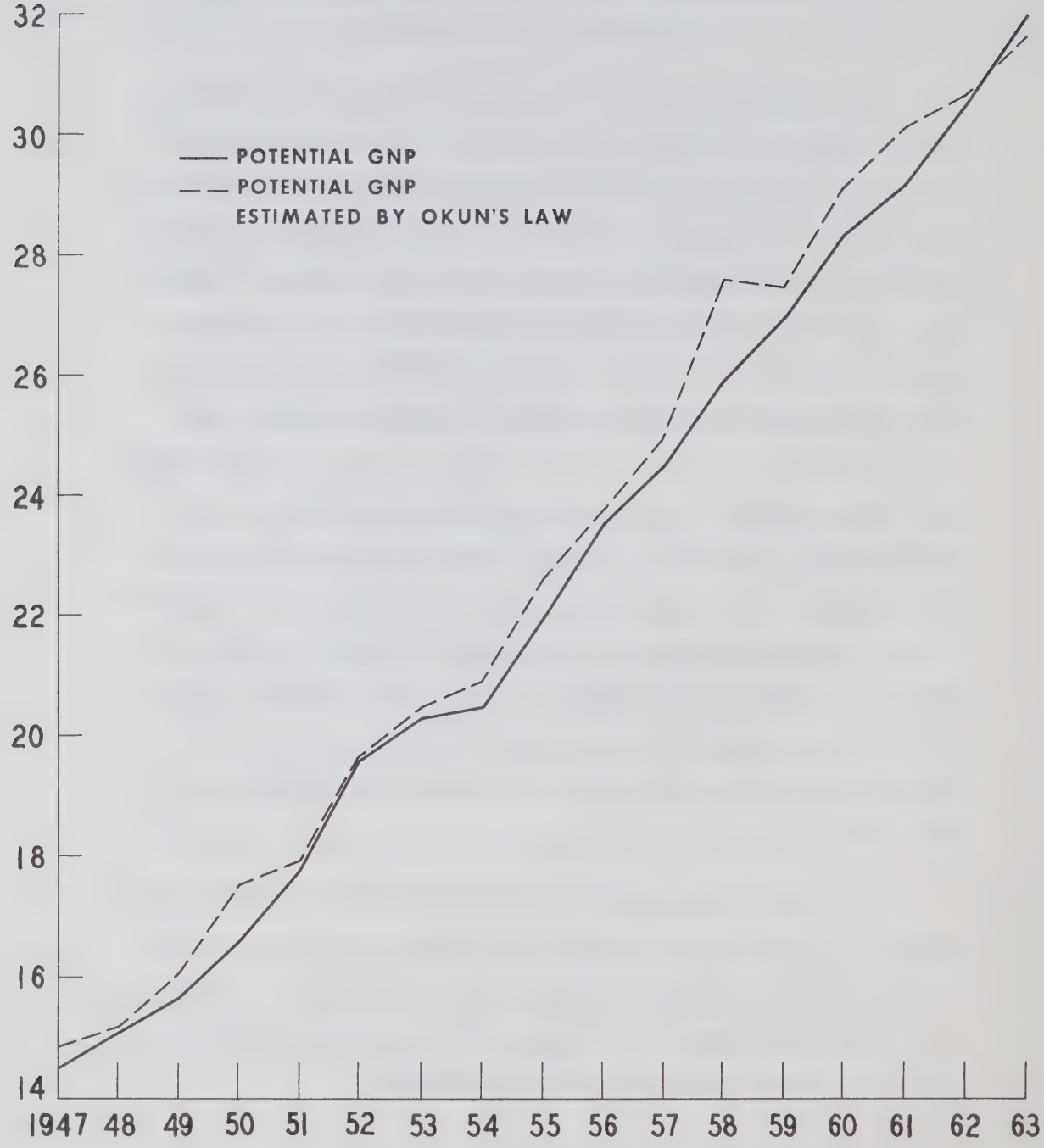
These procedures assume, of course, that the employment elasticity does not change at low levels of unemployment. The available evidence supports this assumption. In their analysis of United States manufacturing data, Wilson and Eckstein 4/ find no evidence of a kink in the relationship between output and unemployment at high levels of utilization of capacity. This is not to deny that inflationary pressures may exist or even that sectoral bottlenecks and labour shortages may occur when the unemployment rate is low. Where capacity bottlenecks or the unavailability of the right kind of labour effectively limits output, a serious excess of demand over supply can arise. Indeed, we would expect this phenomenon to be widespread when unemployment is low and capacity is inadequate as was the case during the early postwar years. What the Potential GNP series implies is that a substantial expansion of output can be obtained by running the economy with a strong inflationary force draft, which indicates that in those sectors in which output can expand—namely, where there are not bottlenecks of labour or capacity—evidently marginal unit labour requirements remain quite low.

It is also worth pointing out that a low elasticity of labour demand per unit of output does not necessarily indicate that unit costs decline as output rises. Increasing output can lead to increasing unit costs because the proportion of overtime hours and the user cost of capital will both rise at high levels of utilization of capacity.

Chart B-1

AN ALTERNATIVE ESTIMATE OF POTENTIAL GNP IN THE POSTWAR PERIOD

Billions of 1949 Dollars



3. A final test takes advantage of the fact that the economy achieved full employment in 1966. This permitted the estimation of yet another potential GNP series. As 1956 and 1966 were both years when the employment rate was very close to the 3.5% target, alternative estimates of potential GNP may be obtained for the 1957-64 period by logarithmic interpolation between the values of actual GNP for 1956 and 1966.

Table B-2 presents this alternative series, together with the potential GNP series used, and the absolute percentage difference between them. By this test, the potential GNP series developed in this paper does very well, as the absolute difference between the two series never exceeds 1.5% and averages 0.6%.

TABLE B-1

AN ALTERNATIVE ESTIMATE OF POTENTIAL GNP IN THE POSTWAR PERIOD
(Millions of Constant (1949) Dollars)

Year	Series Based on Okun's Law 1/	Potential GNP
1947	14823	14479
1948	15159	15054
1949	16038	15640
1950	17524	16579
1951	17920	17772
1952	19654	19591
1953	20467	20279
1954	20918	20440
1955	22575	21951
1956	23740	23521
1957	24992	24464
1958	27567	25904
1959	27437	26935
1960	29109	28314
1961	30062	29157
1962	30634	30436
1963	31606	31944

1/ Calculated from the following assumed relationship:

$$P^* = GNP\ [1 + .032\ (u - 3.5)]$$

where P^* = Potential GNP estimated by Okun's Law, and u is the unemployment rate.

TABLE B-2

POTENTIAL GNP COMPARED WITH SERIES BASED ON "LINKED PEAKS METHOD", 1956-66

Years	Potential GNP	Series Derived by Interpolation Between Full Employment Years	Absolute Difference as a Percentage of Potential GNP
1956	23521	23811*	1.2
1957	24464	24805	1.4
1958	25904	25841	0.2
1959	26935	26920	0.1
1960	28314	28045	1.0
1961	29157	29216	0.2
1962	30436	30437	nil
1963	31944	31708	0.7
1964	n.a.	33033	n.a.
1965	n.a.	34412	n.a.
1966	n.a.	35849*	n.a.
		Average 1956-63	0.6

* Actual GNP used as basis for interpolation of estimates for 1957-65 period.

REFERENCES

1/ Based on the years 1947-63 inclusive.

2/ Arthur M. Okun, "Potential GNP: Its Measurement and Significance," American Statistical Association, Proceedings of the Business and Economic Statistics Section, 1962, pp. 98-104.

3/ The volatility of Potential GNP estimated from Okun's law in the U.S. led Okun himself to recommend use of a smooth trend measure of Potential GNP. [Ibid., p. 101.]

4/ Thomas A. Wilson and Otto Eckstein, "Short-Run Productivity Behavior in U.S. Manufacturing," Review of Economics and Statistics, Feb. 1964, pp. 41-54.

APPENDIX C

DETAILS OF PROJECTION PROCEDURE

In this appendix, we describe the procedure used to construct the B of full employment projection. The A and C projections are obtained by a similar procedure; the final section contains a brief description of the different assumptions made in developing those projections.

Capital Stock Projections

The starting point of the projections is the estimated potential GNP for 1963. It is assumed that full employment is achieved in 1964 and maintained thereafter. Gross investment is assumed to be 14.5% of GNP, and investment in agriculture is projected to grow at the rate observed over the postwar period. Estimated agricultural investment is subtracted from estimated total investment to obtain projected investment in the PNF sector.

Discards from the gross capital stock are assumed to be a constant percentage of the capital stock in the preceding year. This percentage is based on estimated discard rates during the latter half of the postwar period. Gross investment is added and discards subtracted to generate the PNF capital stock for the succeeding year.

Employment and Hours

The labour force and population projections for the period 1964-70 are taken from the study by Denton, Ostry and Kasahara, 1/ who have developed estimates based upon full employment assumptions.

Labour force projections for the period 1971-75 are extrapolated on the basis of the age-sex population growth rates and participation rates projected to 1970 by Denton, Kasahara and Ostry. 2/

Employment in government is projected to increase and agriculture to decrease at the rates observed over the postwar period. Subtracting these estimates from the labour force estimate yields the labour force available to the PNF sector. Potential employment in the PNF sector is 96% of this labour force. The aggregate unemployment rate implicit in this procedure is about 3.5%.

Average weekly hours in the PNF sector are projected to decline at 0.4% per year, a rate somewhat lower than that of the 1962-63 period, but close to the rate observed over the postwar period.

Output

PNF output is obtained by the substitution of the estimates of the capital stock and the estimated man hours into the production function used in the generation of potential output. This is to assume that technical change proceeded at its historical rate.

Agricultural productivity is assumed to grow at the rate observed over the postwar period. The resulting estimate, multiplied by the estimate of agricultural employment described above, yields the estimate of agricultural output used.

Government output, like government employment, is projected to grow at the rate observed over the postwar period.

The sum of PNF output, government output, and agricultural output is multiplied by a constant blow-up factor to obtain potential GNP. This procedure assumes that real residential rents and factors accounting for the difference between national and domestic product remain a constant fraction of GNP.

The resulting estimate of potential GNP is then used to obtain estimates of gross investment to generate the capital stock for the next year. The procedure is repeated for each year in succession generating capital stock, employment and hours, and output projections.

A Projection

The A or under-employment projection differs from the B projection in the following ways:

1. Realized GNP is assumed to be 95% of potential GNP from 1964 on.

2. Investment is projected to be 12.5% of actual GNP.

3. Net immigration per year is assumed to be 25,000 less, and the labour force estimates adjusted accordingly, taking into account the higher labour force participation rates of immigrants.

4. Average weekly hours are assumed to decline at a rate of 0.5% per year.

The projections are then developed in the same fashion as described for the B projection.

C Projection

The C projection differs from the B projection in one way only—investment is assumed to be 16% of potential GNP.

REFERENCES

1/ F. J. Denton, Y. Kasahara, and S. Ostry, Population and Labour Force Projections to 1970, Economic Council of Canada, 1965, Table 2, p. 38.

2/ Ibid., Tables 8 and 9, pp. 16-17, and Table 6, p. 42.